FIG.1

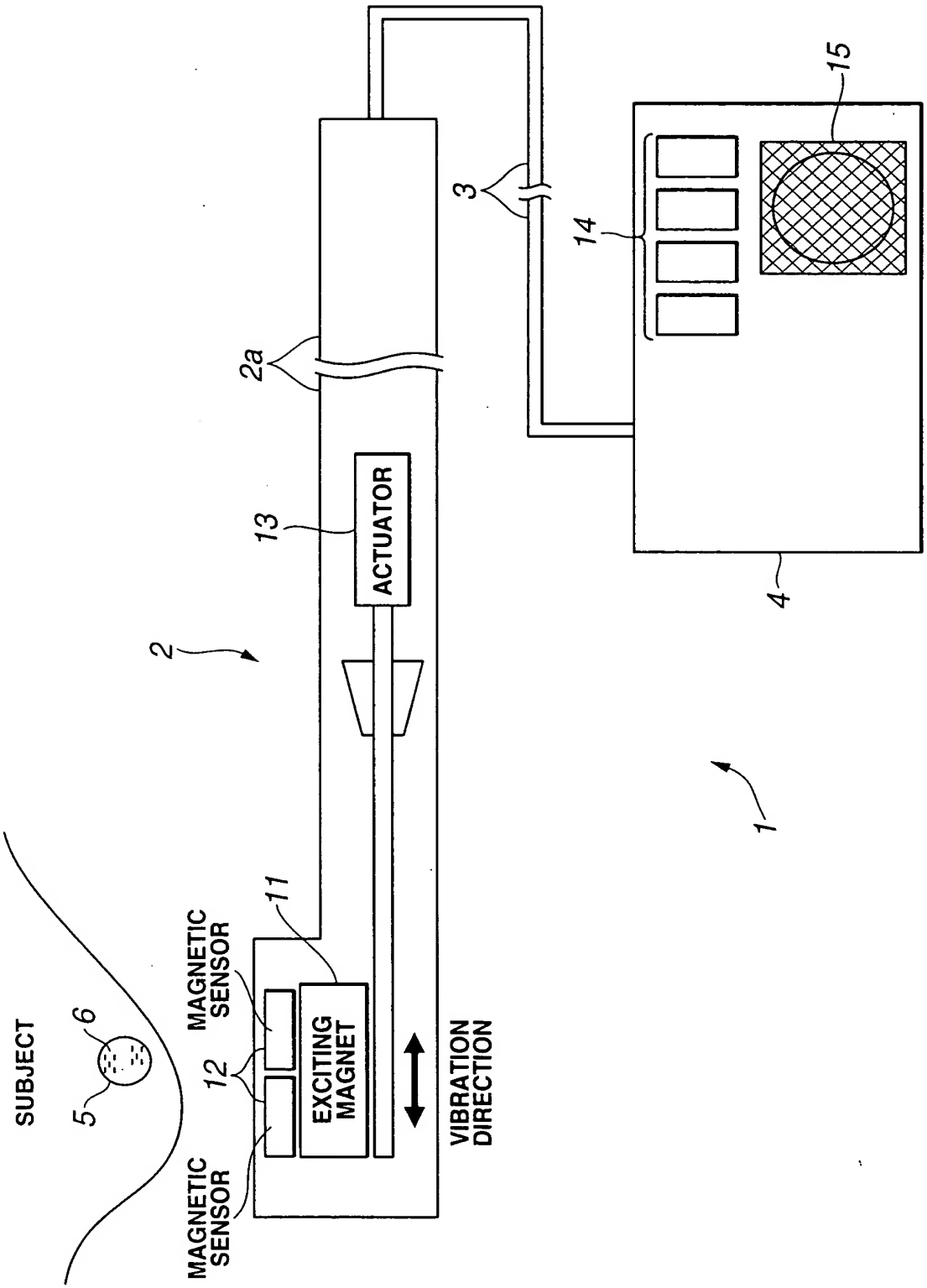


FIG.2A

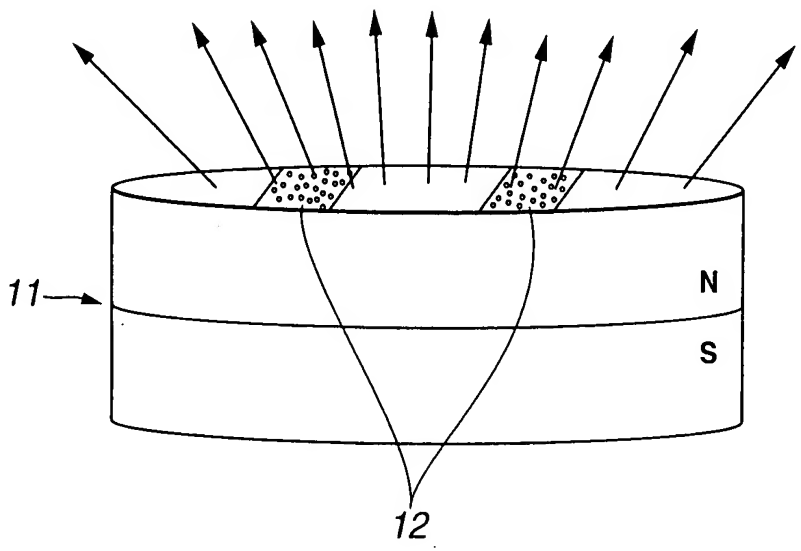


FIG.2B

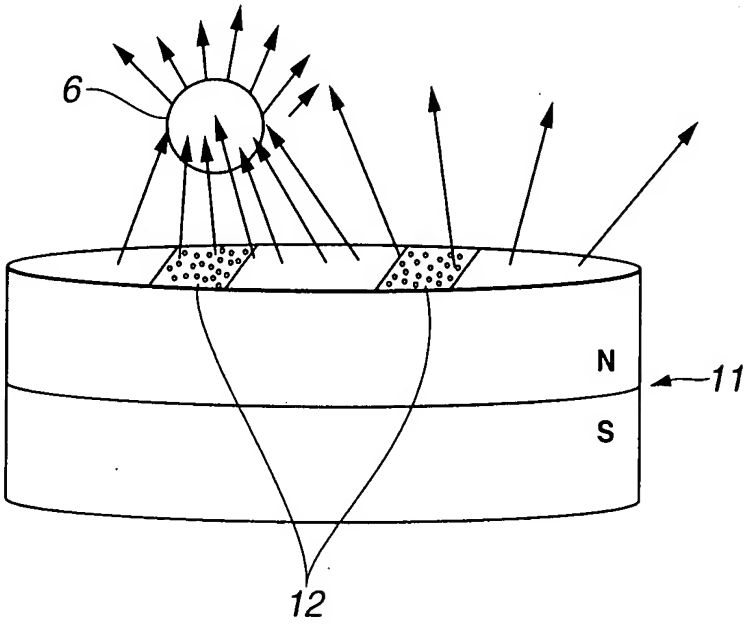


FIG.3A

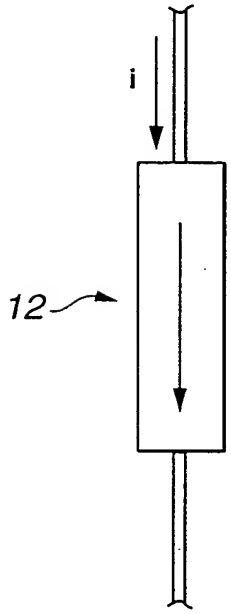


FIG.3B

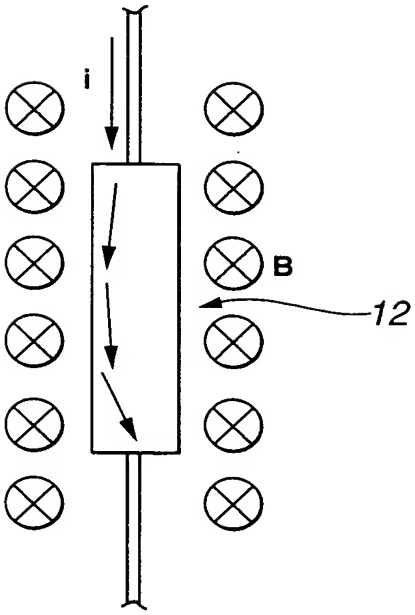


FIG.4A

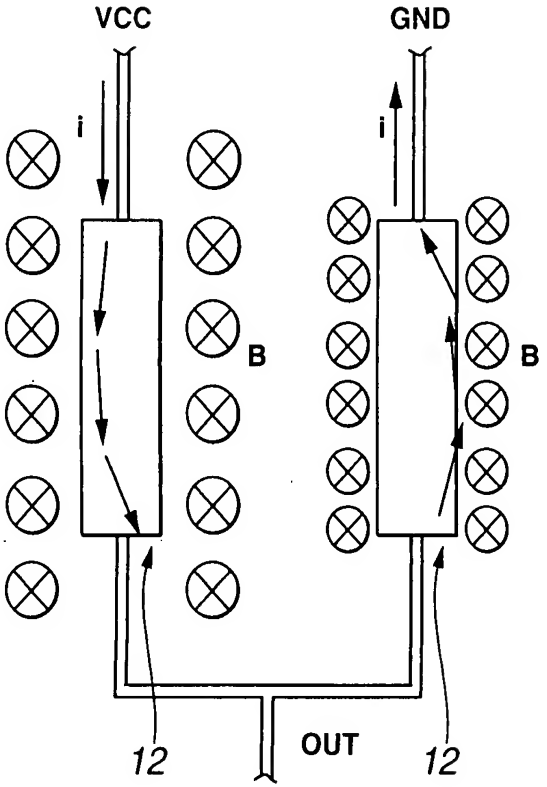


FIG.4B

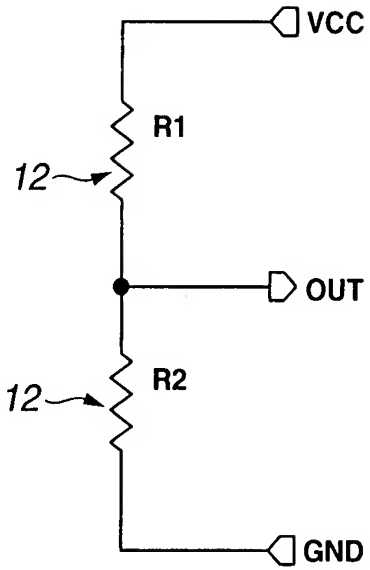


FIG.4C

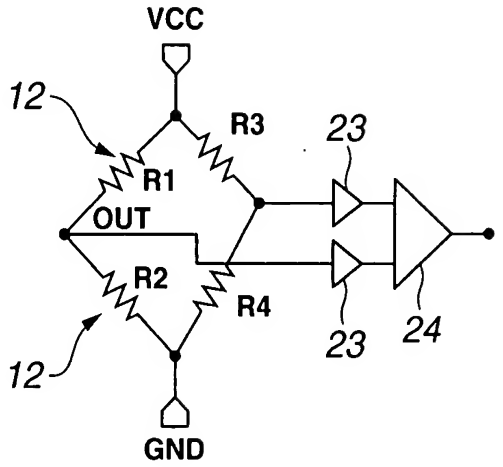


FIG.5

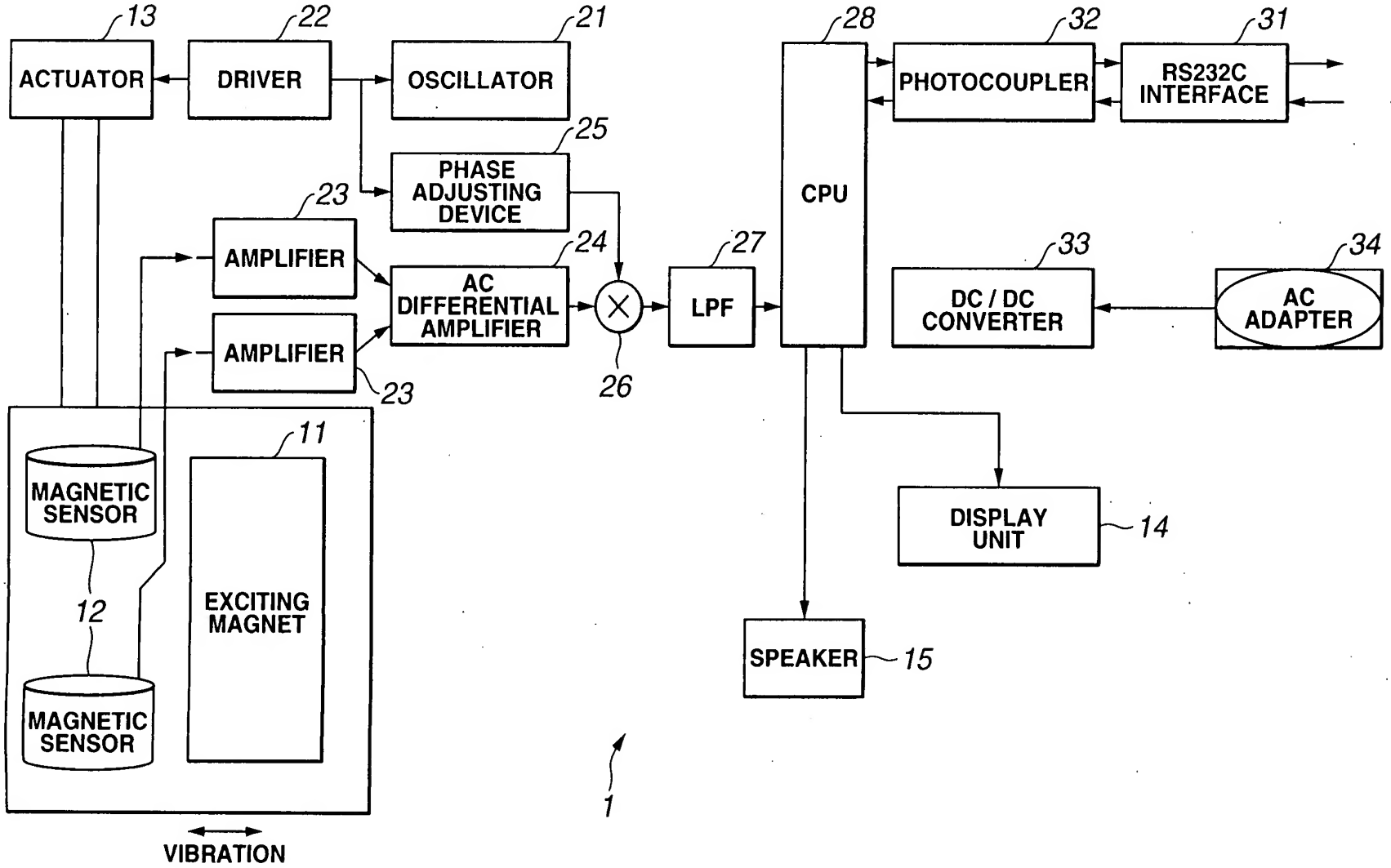

13
ACTUATOR
22
DRIVER
21
OSCILLATOR
28
CPU
32
PHOTOCOUPLER
31
RS232C INTERFACE
25
PHASE ADJUSTING DEVICE
23
AMPLIFIER
24
AC DIFFERENTIAL AMPLIFIER
27
LPF
33
DC / DC CONVERTER
34
AC ADAPTER
AMPLIFIER
23
26
11
MAGNETIC SENSOR
EXCITING MAGNET
DISPLAY UNIT
14
12
SPEAKER
15
MAGNETIC SENSOR
1
VIBRATION

FIG.6

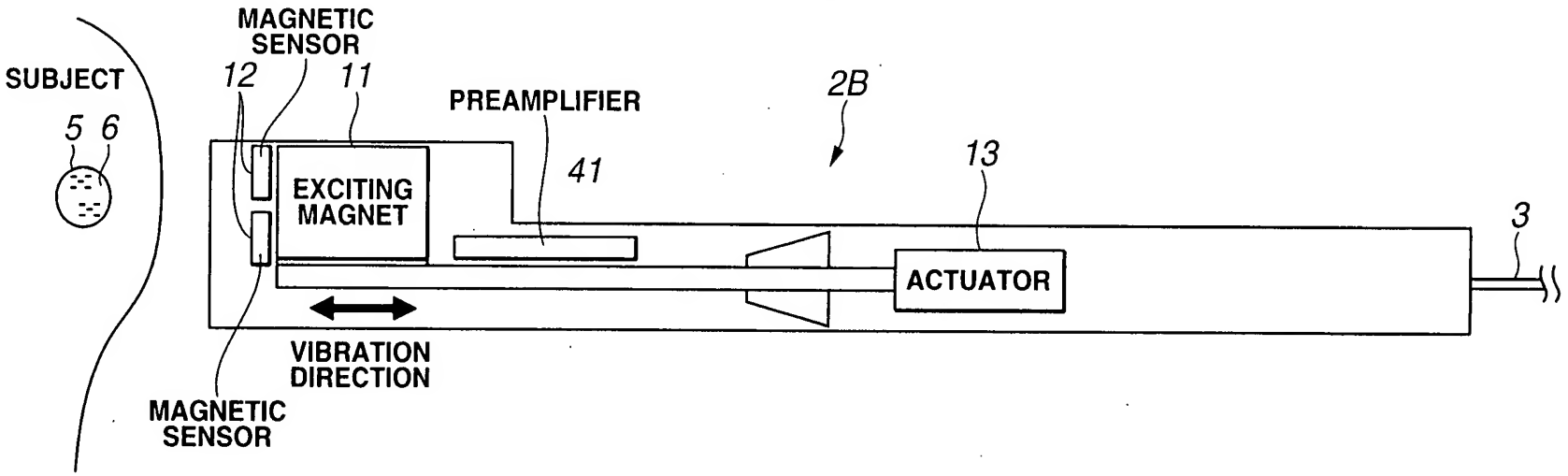

SUBJECT
5 6
MAGNETIC SENSOR
12
11
EXCITING MAGNET
PREAMPLIFIER
41
2B
13
3
ACTUATOR
VIBRATION DIRECTION
MAGNETIC SENSOR

FIG.8

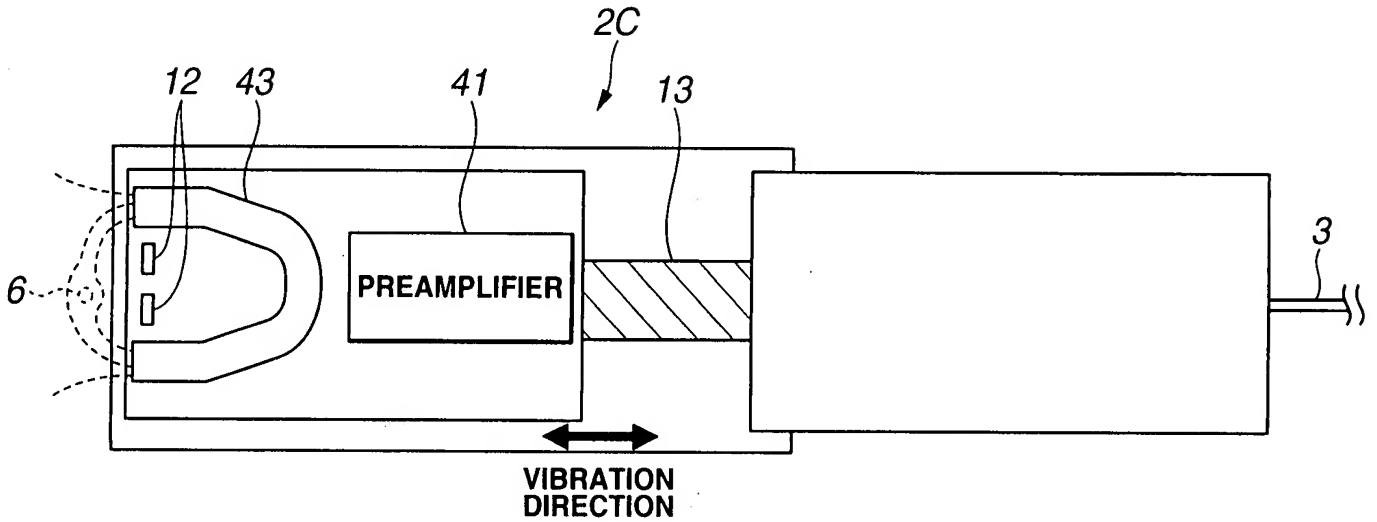

2C
12
43
41
13
3
6
PREAMPLIFIER
VIBRATION DIRECTION

FIG.7

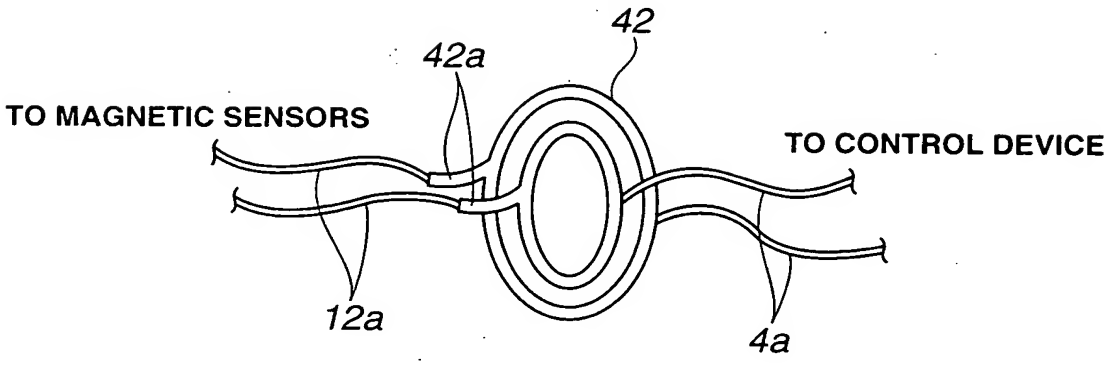


FIG.12

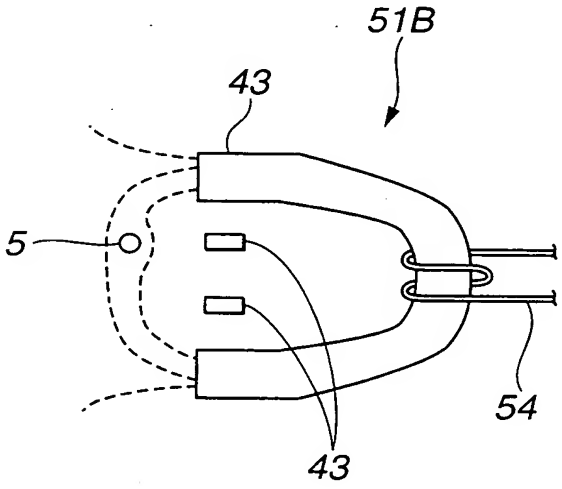


FIG.16A

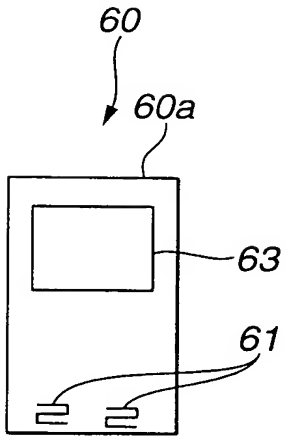


FIG.16B

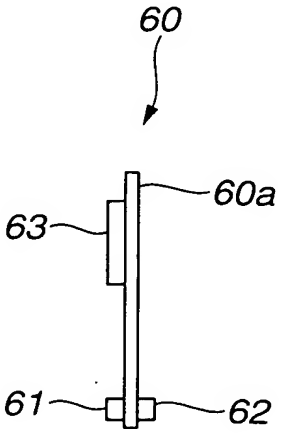


FIG.9

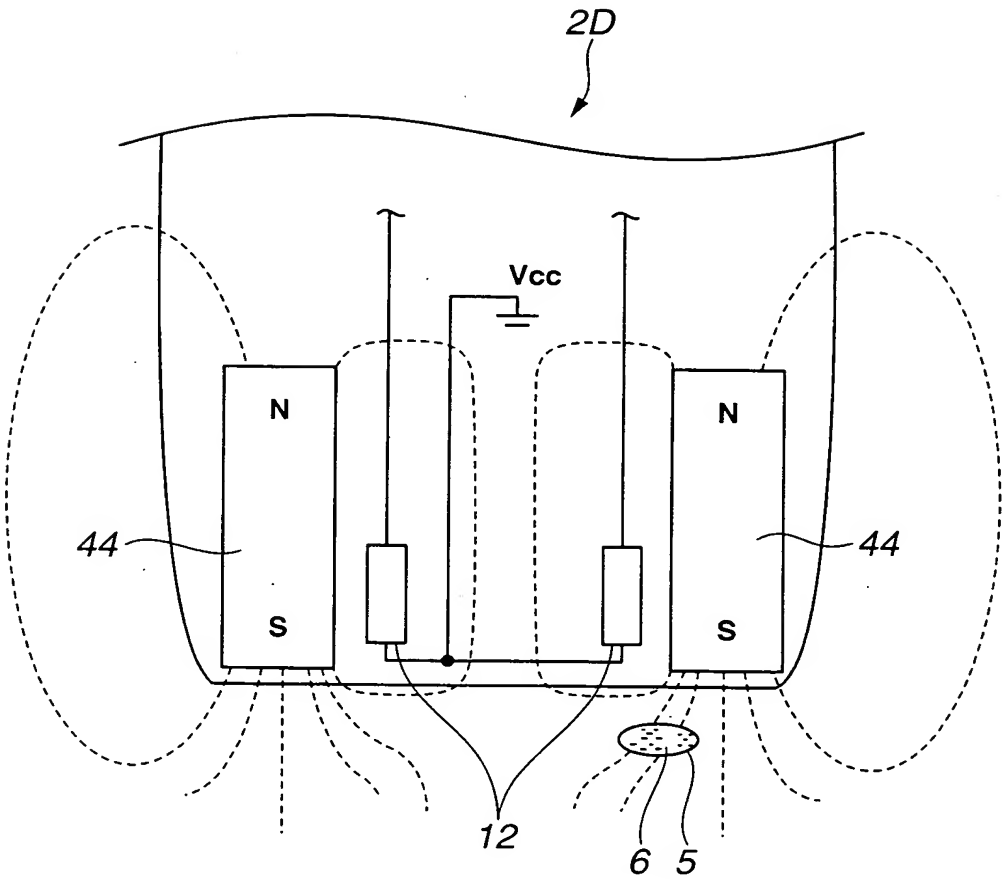


FIG.10

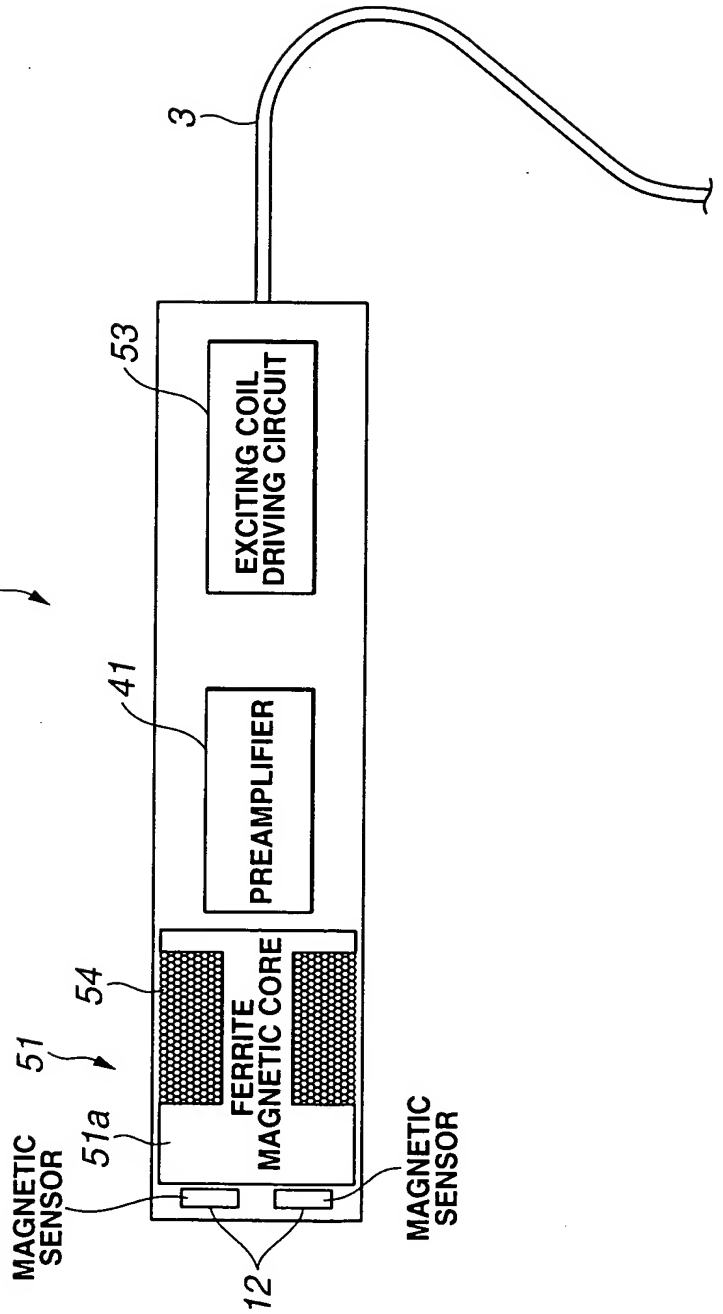

3
53
EXCITING COIL DRIVING CIRCUIT
52
41
PREAMPLIFIER
54
FERRITE MAGNETIC CORE
51
51a
MAGNETIC SENSOR
MAGNETIC SENSOR
12

FIG.11

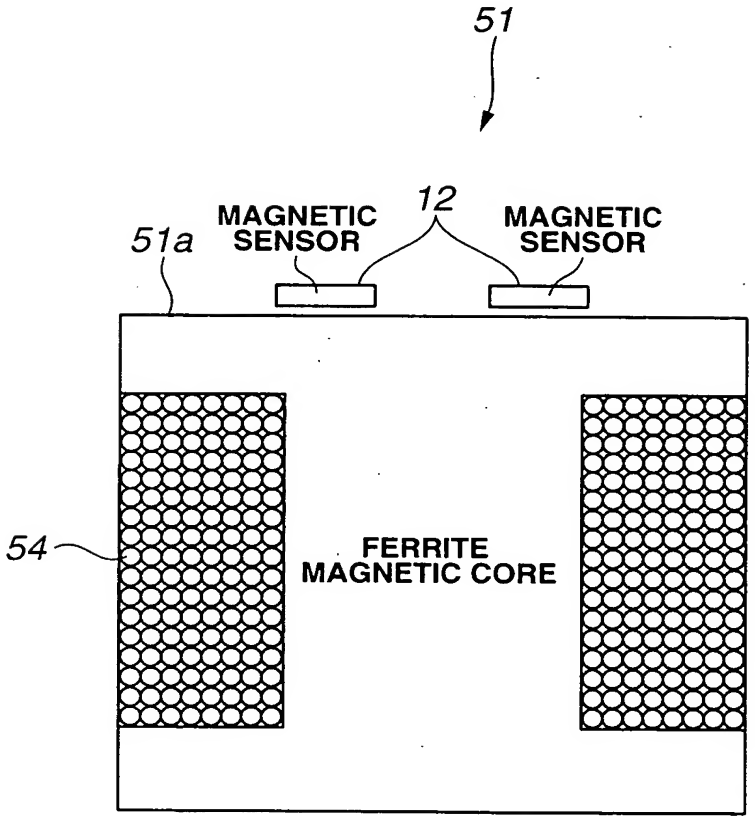

51
12
MAGNETIC SENSOR
MAGNETIC SENSOR
51a
54
FERRITE MAGNETIC CORE

FIG.13

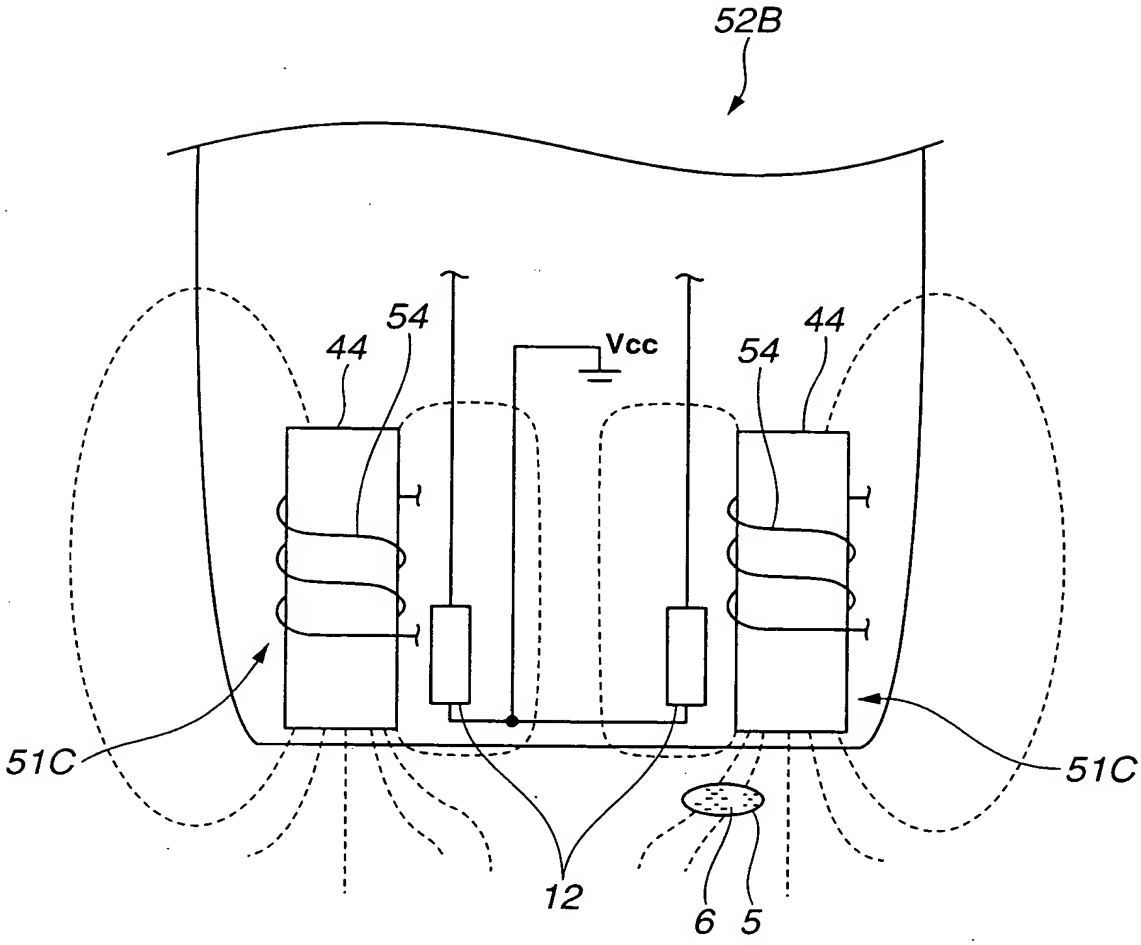


FIG.14A

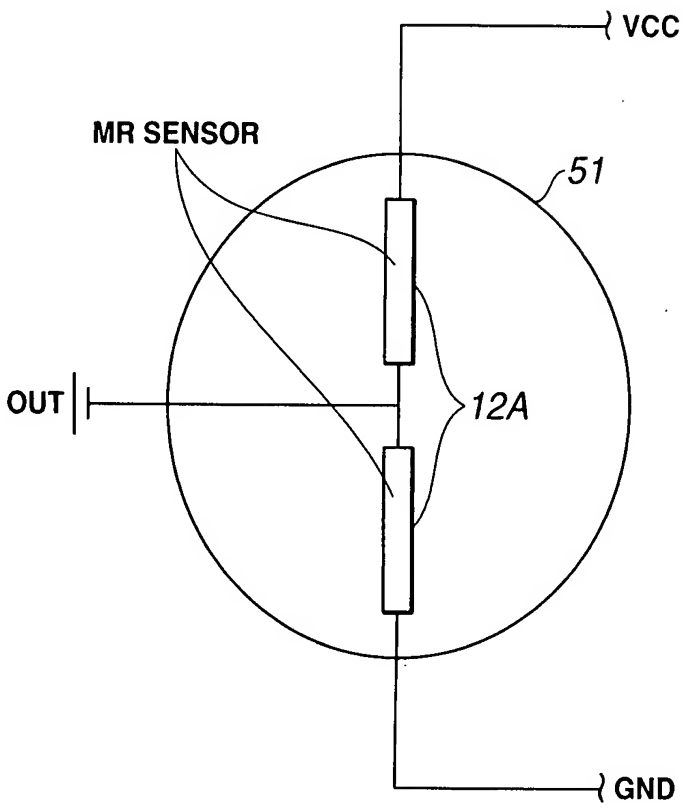


FIG.14B

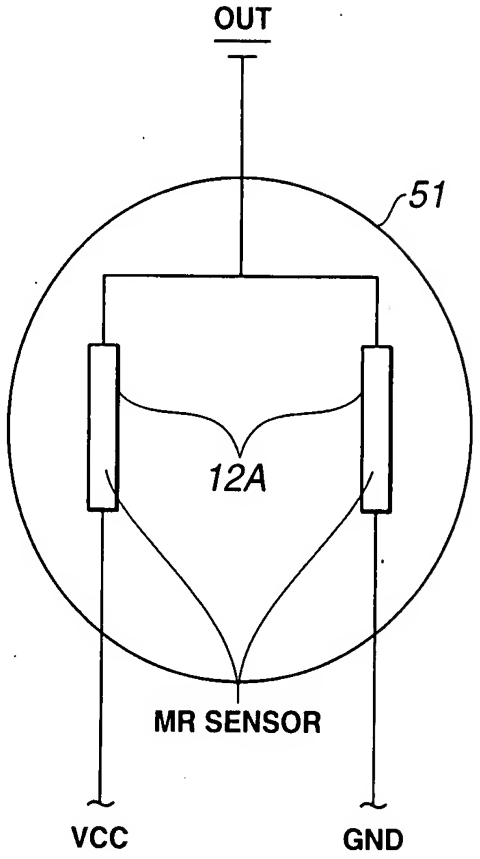


FIG.15

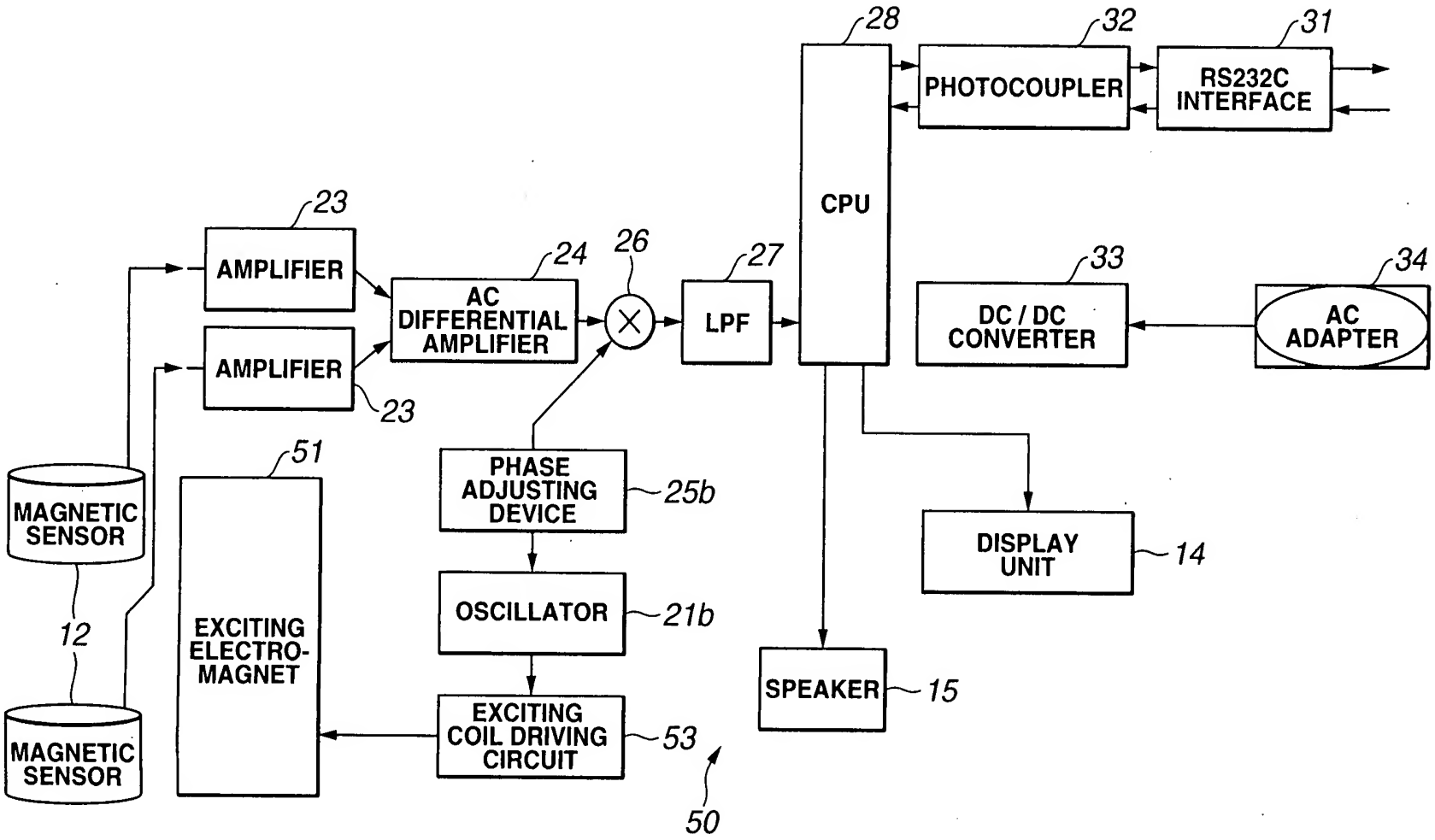

28
32
31
PHOTOCOUPLER
RS232C INTERFACE
CPU
23
AMPLIFIER
24
AC DIFFERENTIAL AMPLIFIER
26
27
LPF
33
DC / DC CONVERTER
34
AC ADAPTER
AMPLIFIER
23
51
MAGNETIC SENSOR
PHASE ADJUSTING DEVICE
25b
DISPLAY UNIT
14
EXCITING ELECTRO-MAGNET
OSCILLATOR
21b
12
SPEAKER
15
MAGNETIC SENSOR
EXCITING COIL DRIVING CIRCUIT
53
50

FIG.17

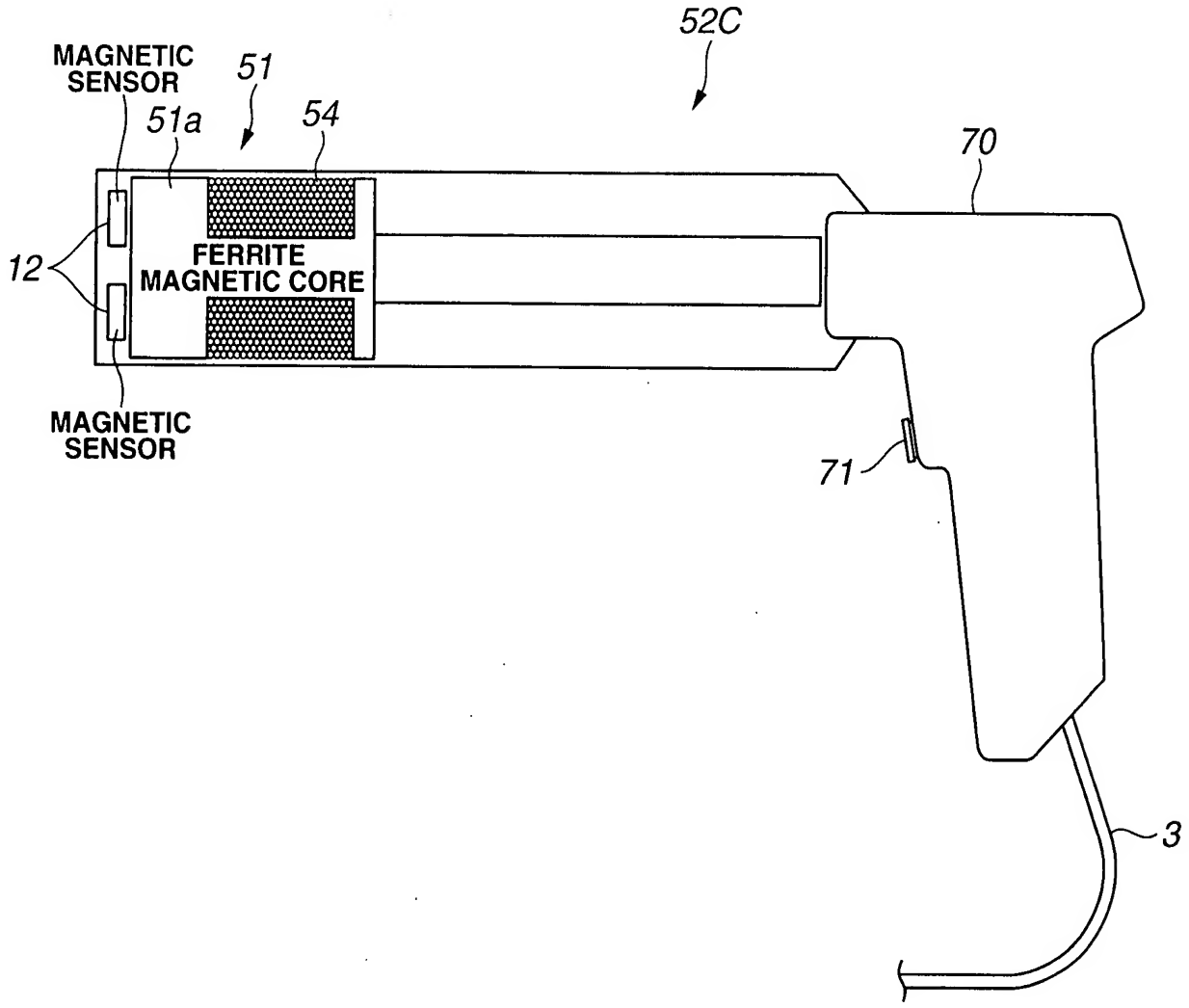

52C
MAGNETIC SENSOR
51
51a
54
70
12
FERRITE MAGNETIC CORE
MAGNETIC SENSOR
71
3

FIG.18

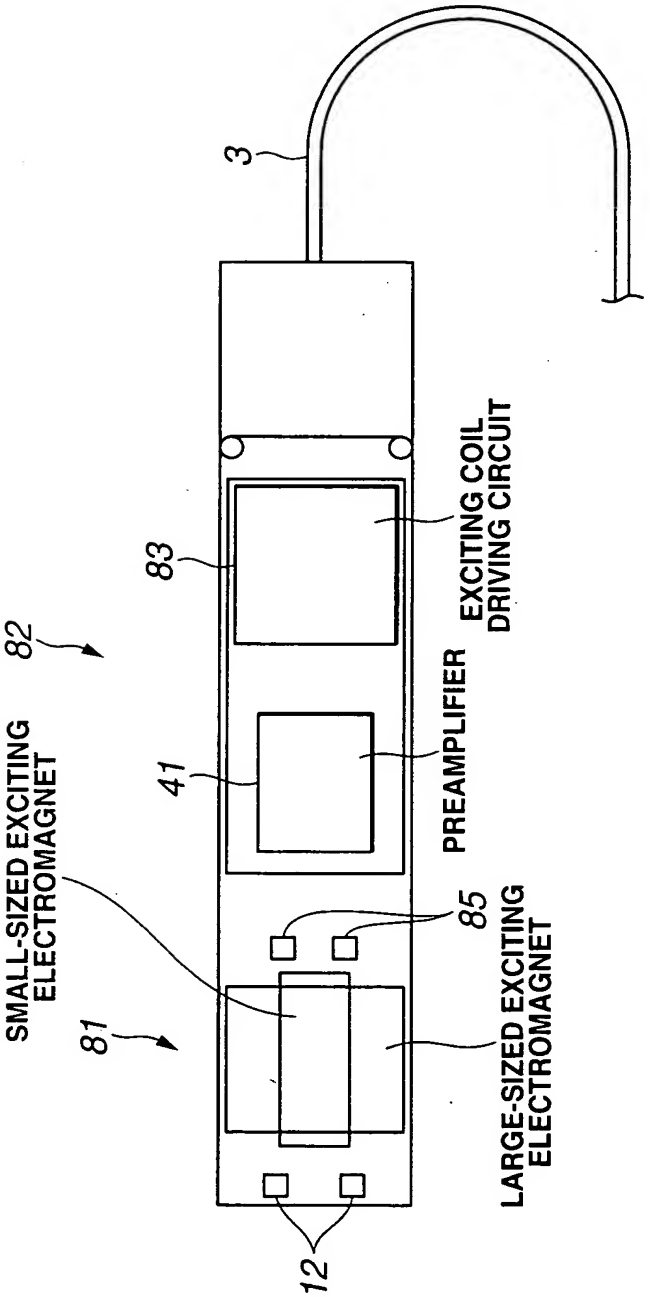

3
83
82
EXCITING COIL DRIVING CIRCUIT
41
PREAMPLIFIER
SMALL-SIZED EXCITING ELECTROMAGNET
85
81
LARGE-SIZED EXCITING ELECTROMAGNET
12

FIG.19

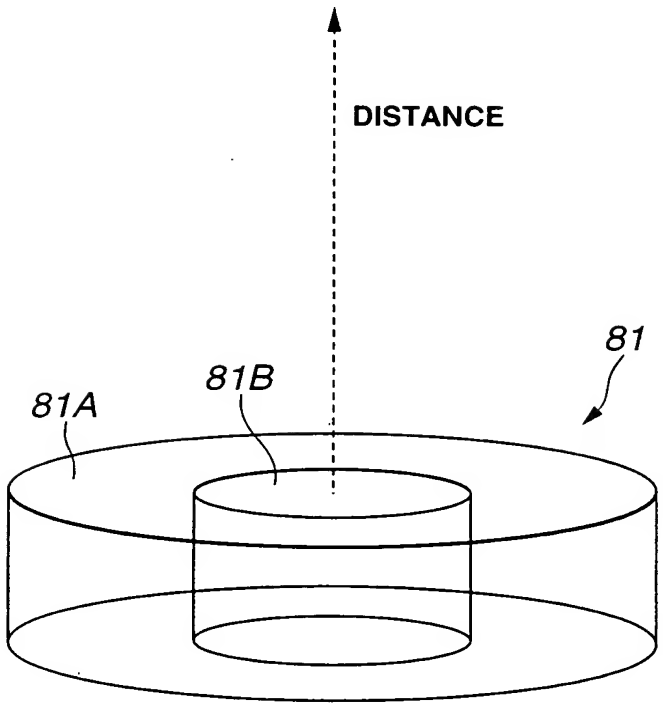

DISTANCE
81
81B
81A

FIG.20

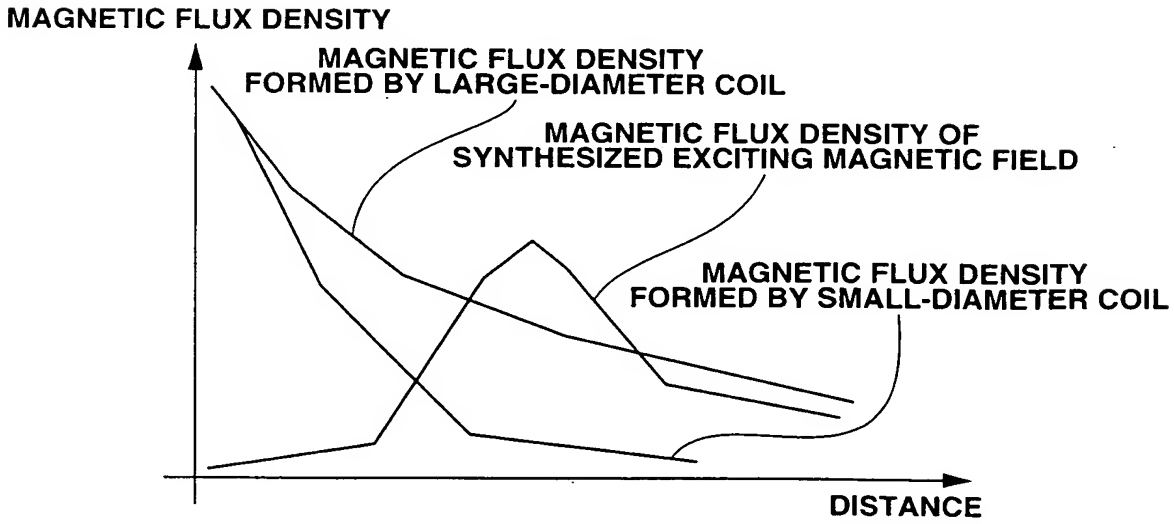

MAGNETIC FLUX DENSITY
MAGNETIC FLUX DENSITY
FORMED BY LARGE-DIAMETER COIL
MAGNETIC FLUX DENSITY OF
SYNTHESIZED EXCITING MAGNETIC FIELD
MAGNETIC FLUX DENSITY
FORMED BY SMALL-DIAMETER COIL
DISTANCE

FIG.21

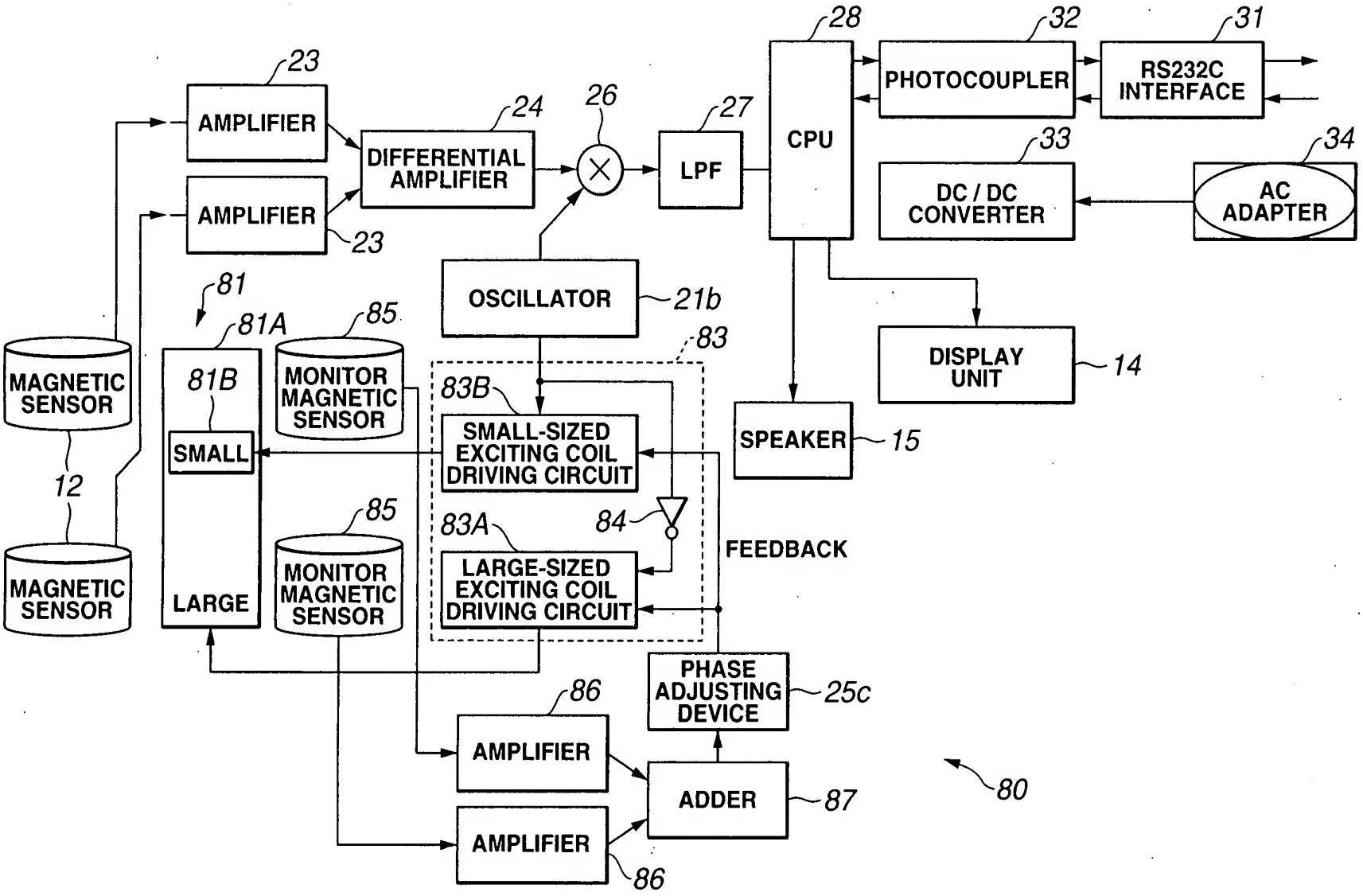
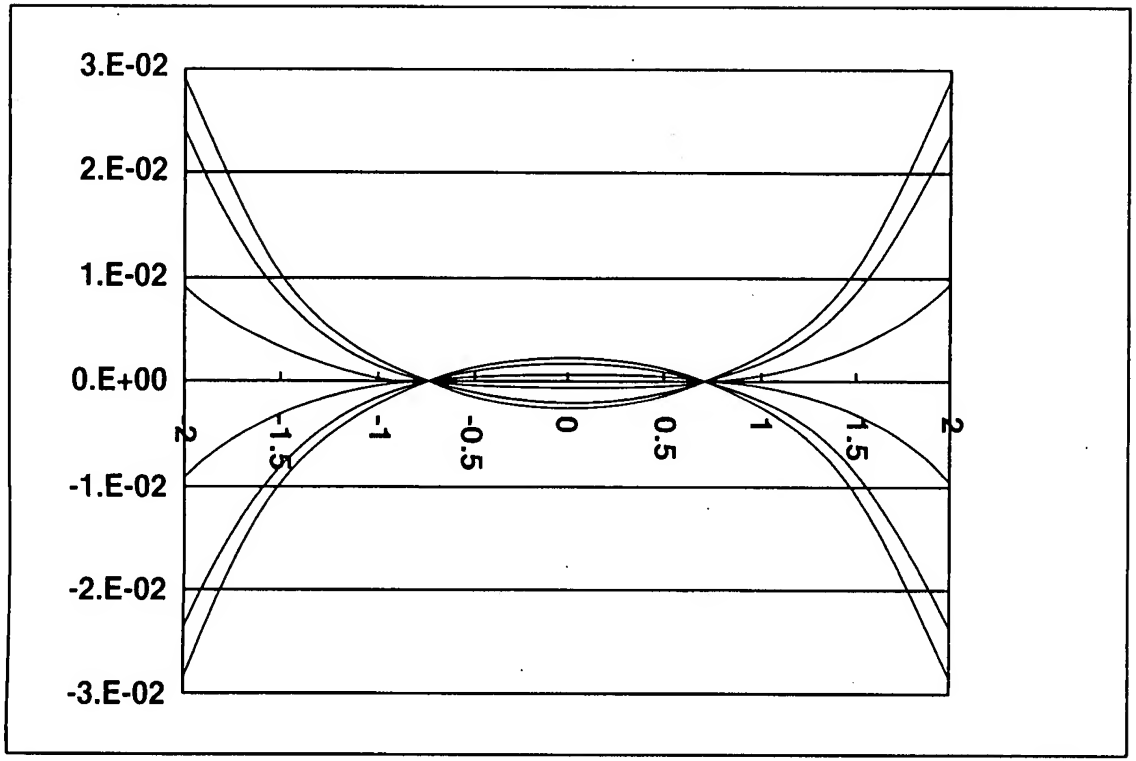
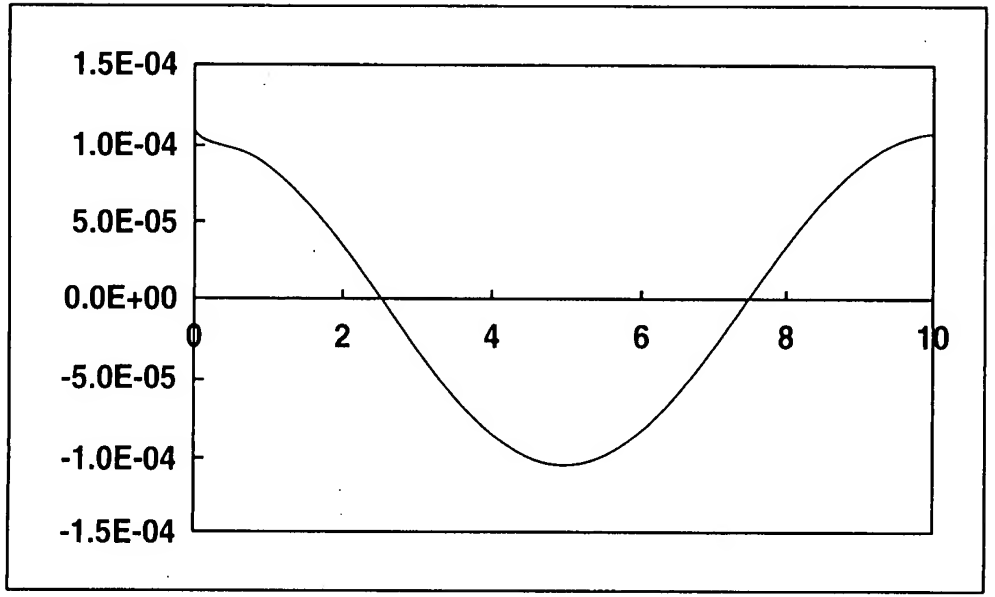

28
32
31
23
AMPLIFIER
24
26
27
PHOTOCOUPLER
RS232C INTERFACE
CPU
DIFFERENTIAL AMPLIFIER
LPF
33
34
AMPLIFIER
23
DC / DC CONVERTER
AC ADAPTER
81
OSCILLATOR
21b
81A
85
83
MAGNETIC SENSOR
81B
MONITOR MAGNETIC SENSOR
83B
DISPLAY UNIT
14
SMALL
SMALL-SIZED EXCITING COIL DRIVING CIRCUIT
SPEAKER
15
12
85
84
83A
FEEDBACK
MAGNETIC SENSOR
LARGE
MONITOR MAGNETIC SENSOR
LARGE-SIZED EXCITING COIL DRIVING CIRCUIT
PHASE ADJUSTING DEVICE
25c
86
AMPLIFIER
ADDER
87
80
AMPLIFIER
86

FIG.22



X: POSITION OF SENSOR FACE (mm)
Y: MAGNETIC FLUX DENSITY (T)
CHANGE IN MAGNETIC FLUX DENSITY AS TO POSITION WITH TIME AS A PARAMETER

FIG.23



CHANGE IN DIFFERENTIAL OUTPUT OVER TIME
X: TIME AS TO ALTERNATING MAGNETIC FIELD (S)
Y: DIFFERENTIAL OUTPUT FROM SENSOR (T)
DISTANCE BETWEEN SENSORS: ±0.75 mm
POSITION OF MAGNETIC FLULD X AXIS 1mm, Y AXIS 1 mm

FIG.24

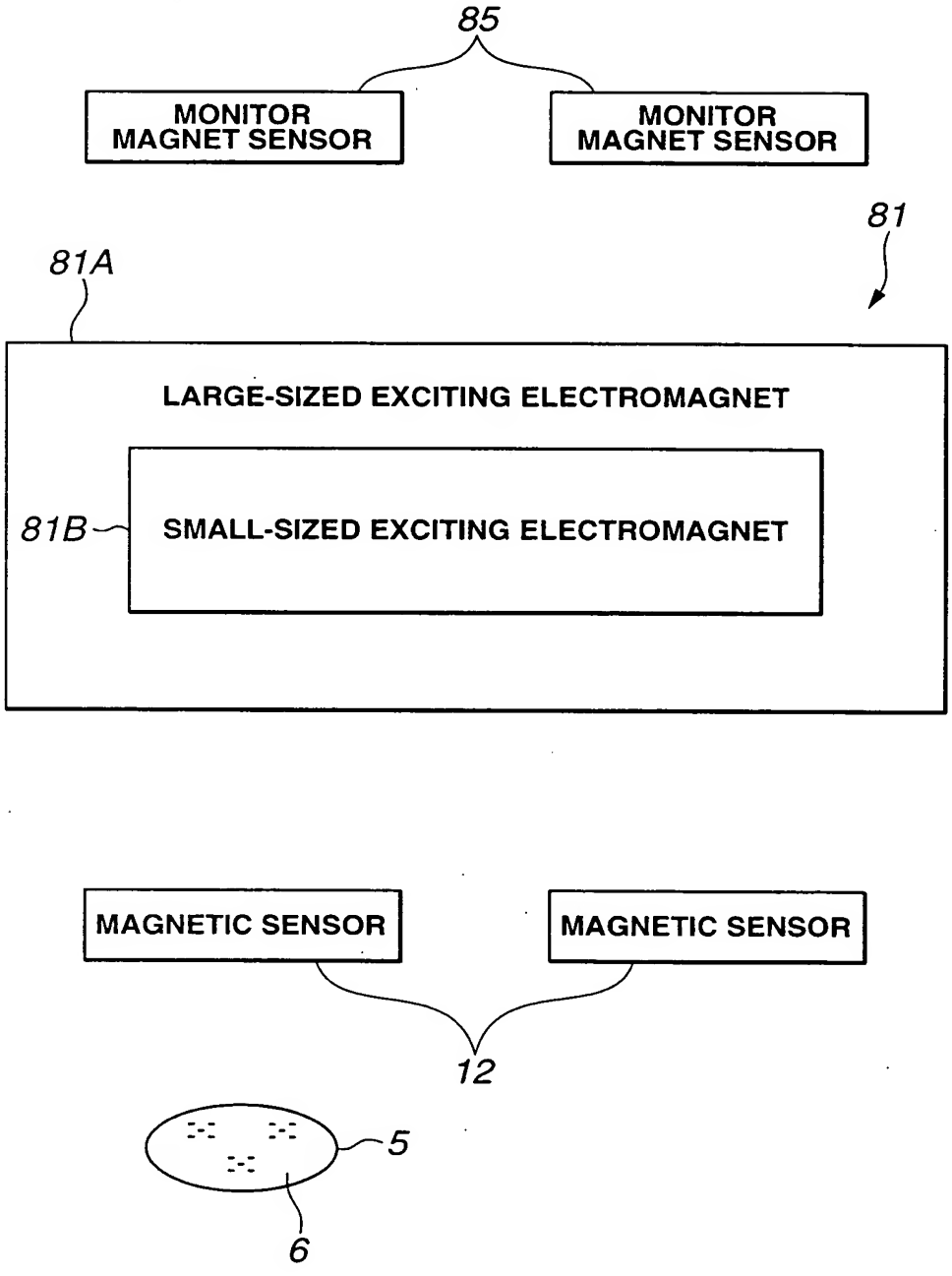

85
MONITOR MAGNET SENSOR
MONITOR MAGNET SENSOR
81
81A
LARGE-SIZED EXCITING ELECTROMAGNET
81B
SMALL-SIZED EXCITING ELECTROMAGNET
MAGNETIC SENSOR
MAGNETIC SENSOR
12
5
6

FIG.25

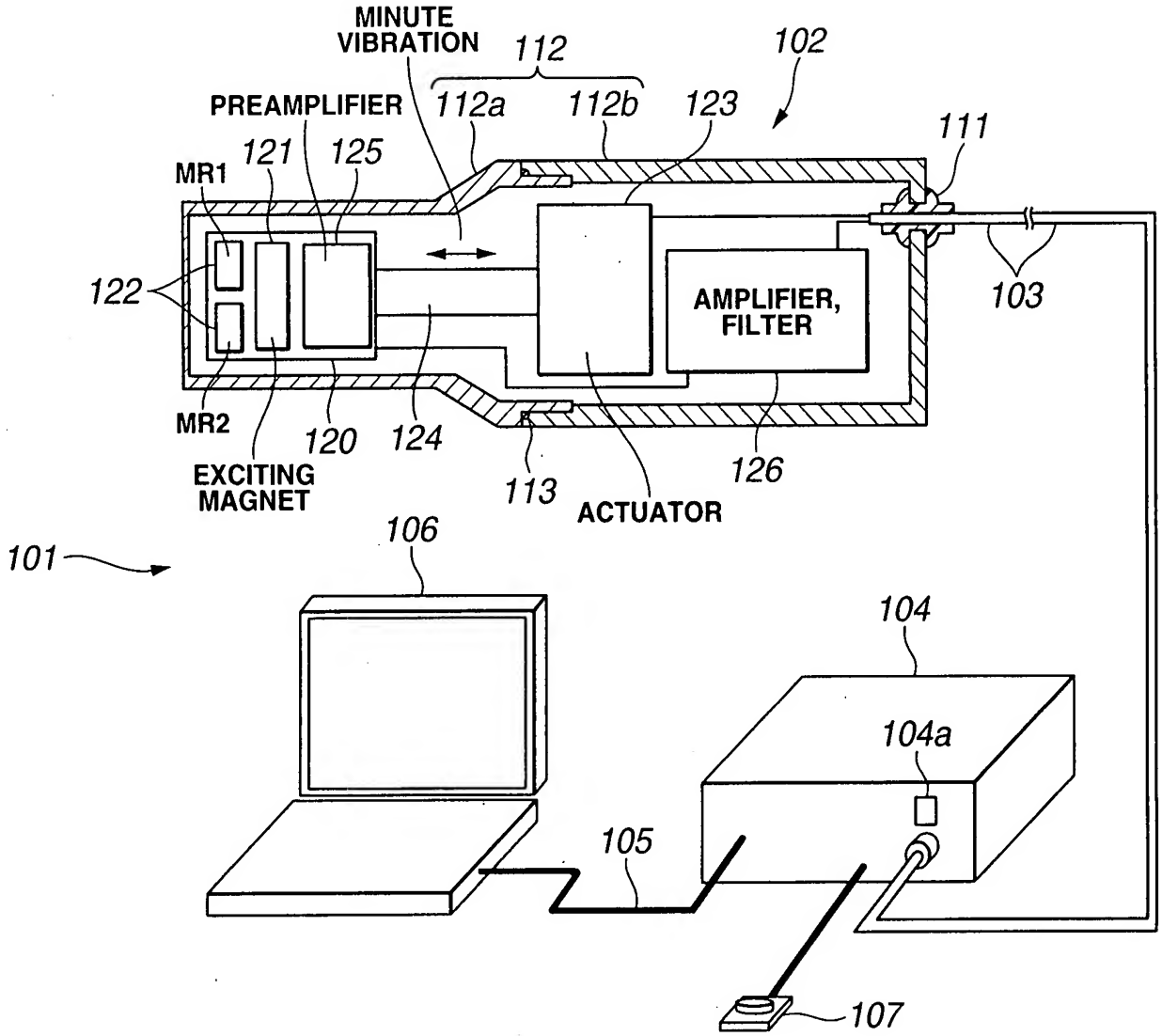

MINUTE VIBRATION
112
102
PREAMPLIFIER
112a
112b
123
111
121
125
MR1
122
AMPLIFIER, FILTER
103
MR2
120
124
126
EXCITING MAGNET
113
ACTUATOR
101
106
104
104a
105
107

FIG.26

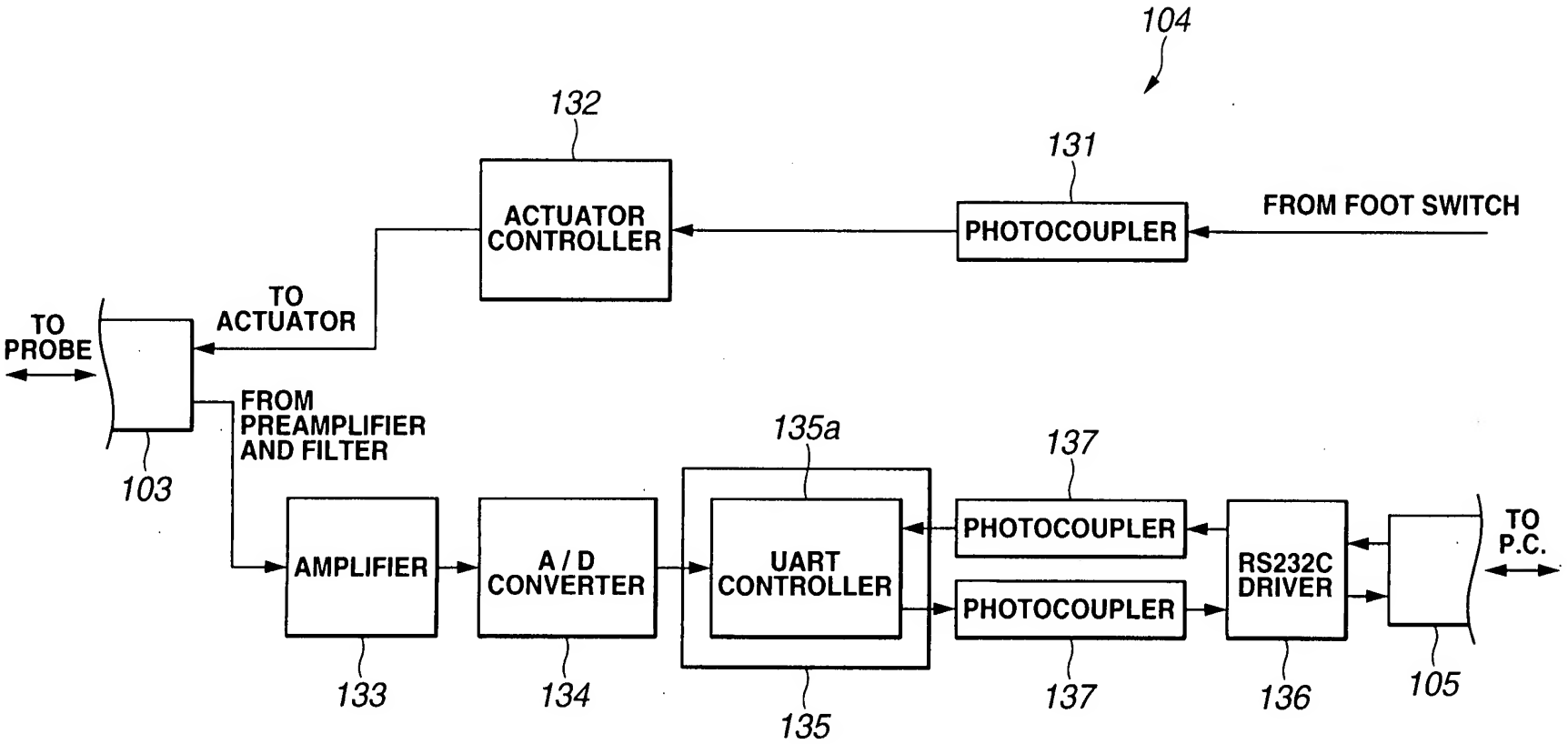

104
132
131
ACTUATOR CONTROLLER
PHOTOCOUPLER
FROM FOOT SWITCH
TO ACTUATOR
TO PROBE
FROM PREAMPLIFIER AND FILTER
103
135a
137
AMPLIFIER
A / D CONVERTER
UART CONTROLLER
PHOTOCOUPLER
PHOTOCOUPLER
RS232C DRIVER
TO P.C.
133
134
135
137
136
105

FIG.27

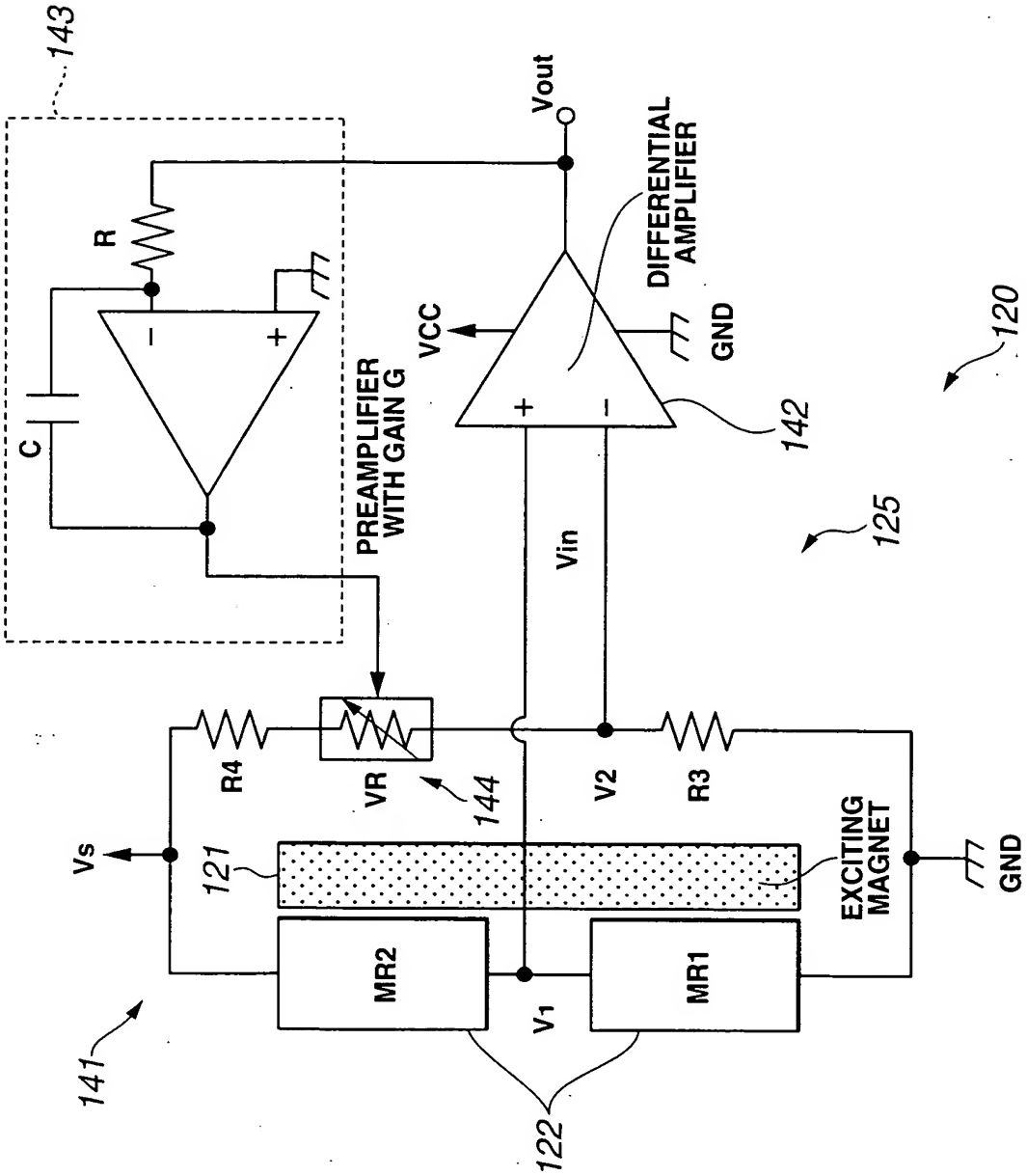

143
Vout
R
C
PREAMPLIFIER WITH GAIN G
DIFFERENTIAL AMPLIFIER
VCC
GND
120
142
125
Vin
R4
VR
144
V2
R3
Vs
121
EXCITING MAGNET
GND
MR2
MR1
V1
141
122

FIG.28

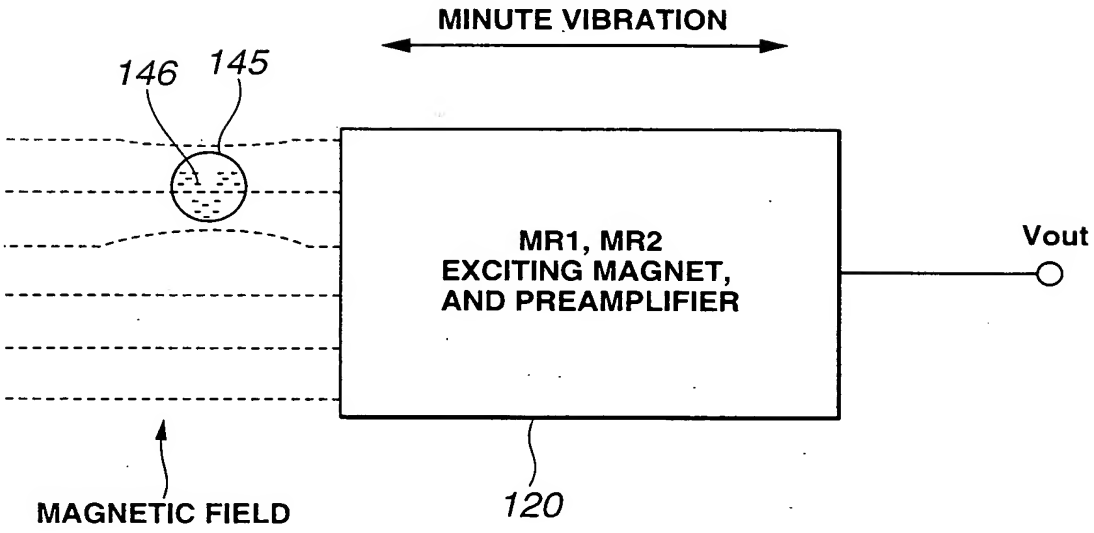

MINUTE VIBRATION
146
145
MR1, MR2
EXCITING MAGNET,
AND PREAMPLIFIER
Vout
MAGNETIC FIELD
120

FIG.29

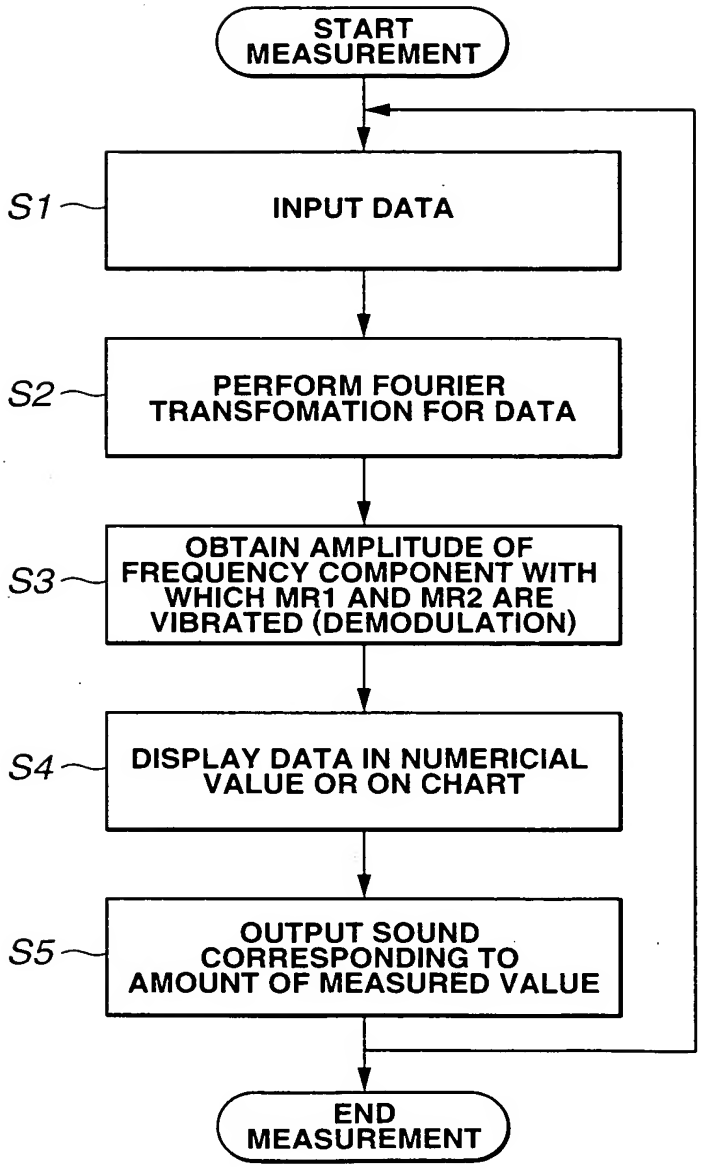

START MEASUREMENT
S1
INPUT DATA
S2
PERFORM FOURIER TRANSFOMATION FOR DATA
S3
OBTAIN AMPLITUDE OF FREQUENCY COMPONENT WITH WHICH MR1 AND MR2 ARE VIBRATED (DEMODULATION)
S4
DISPLAY DATA IN NUMERICIAL VALUE OR ON CHART
S5
OUTPUT SOUND CORRESPONDING TO AMOUNT OF MEASURED VALUE
END MEASUREMENT

FIG.30

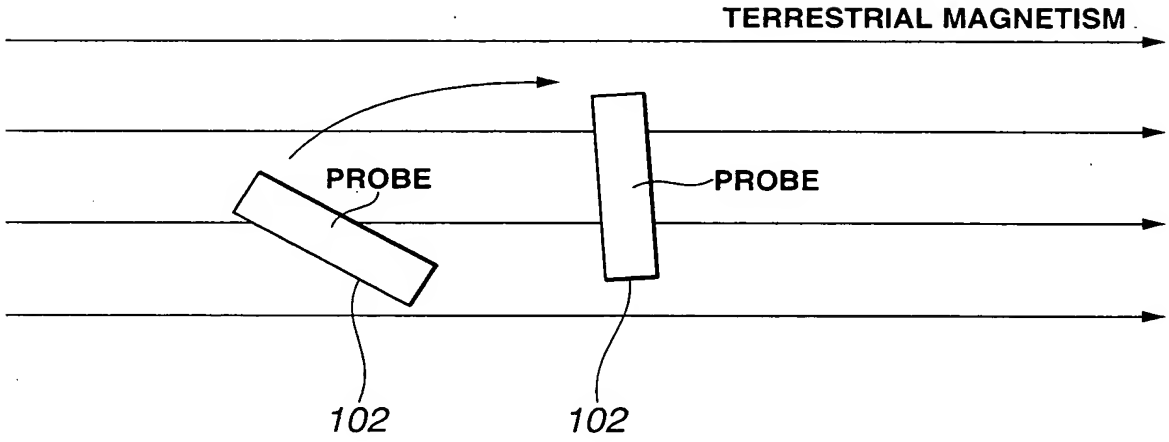


FIG.31

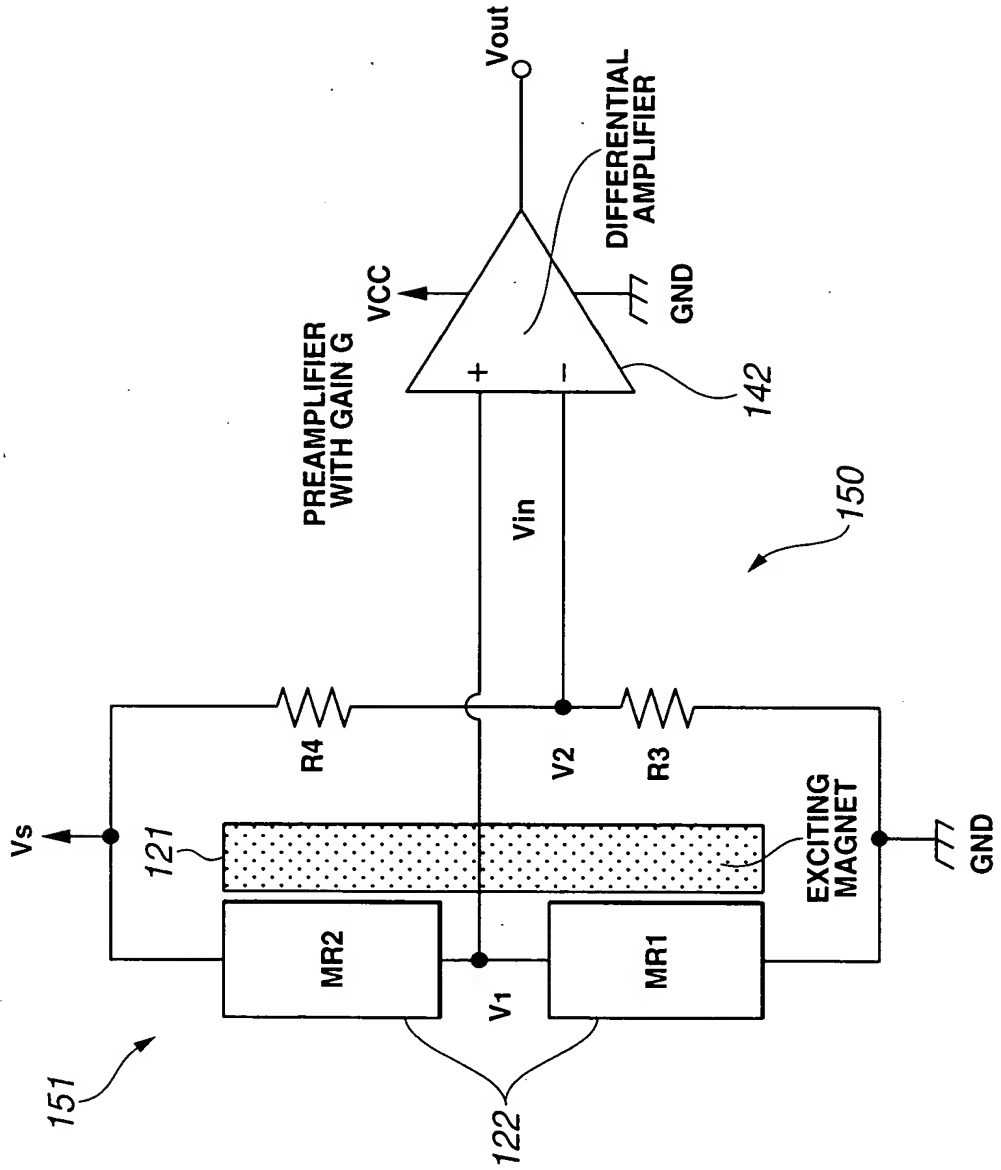

Vout
DIFFERENTIAL AMPLIFIER
VCC
GND
PREAMPLIFIER WITH GAIN G
+
−
142
Vin
150
R4
V2
R3
Vs
121
EXCITING MAGNET
GND
MR2
MR1
V1
151
122

FIG.32

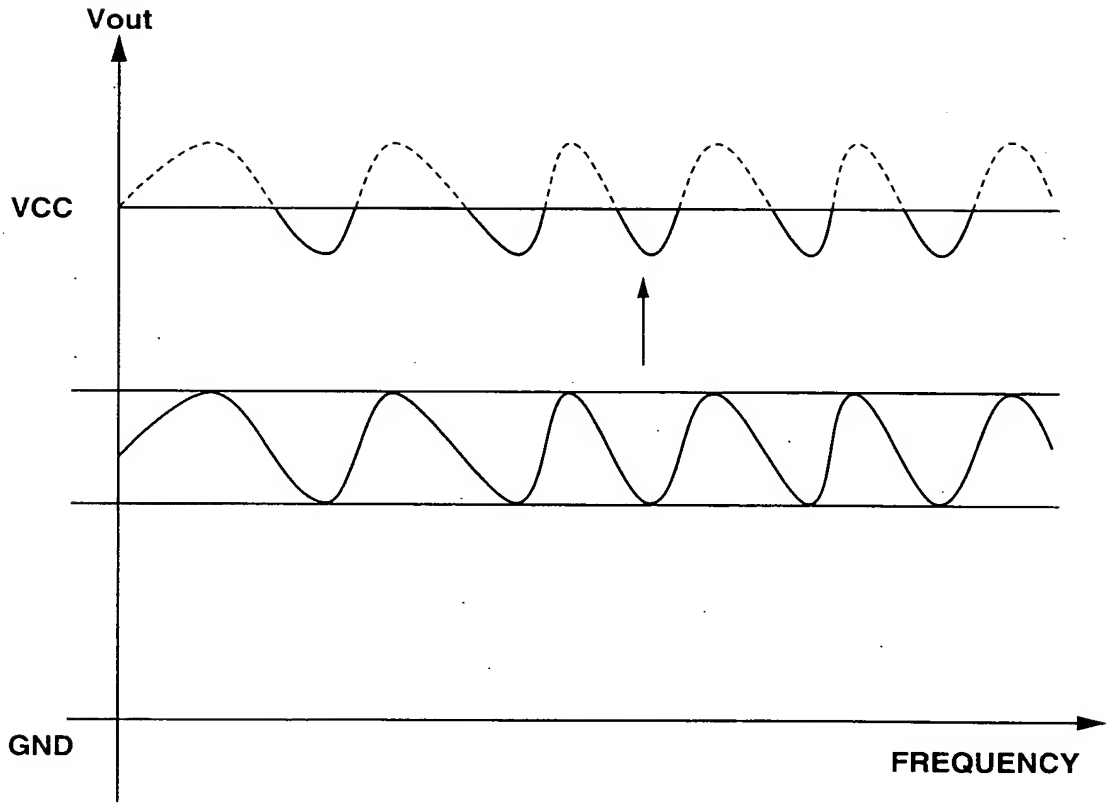


FIG.33

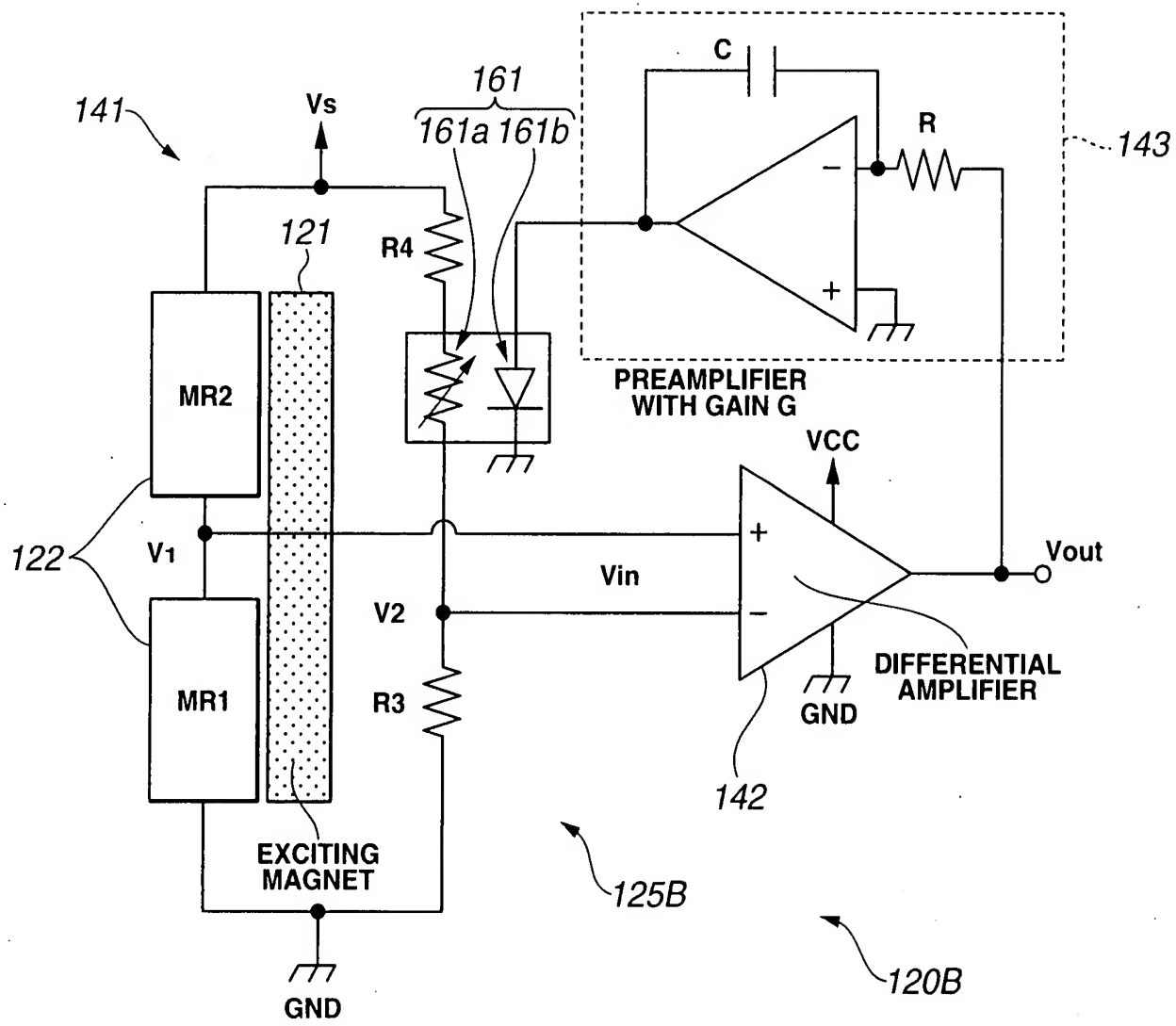

141
Vs
161
161a 161b
C
R
143
121
R4
MR2
PREAMPLIFIER
WITH GAIN G
VCC
122
V1
Vin
Vout
V2
MR1
R3
DIFFERENTIAL
AMPLIFIER
GND
142
EXCITING
MAGNET
125B
120B
GND

FIG.34

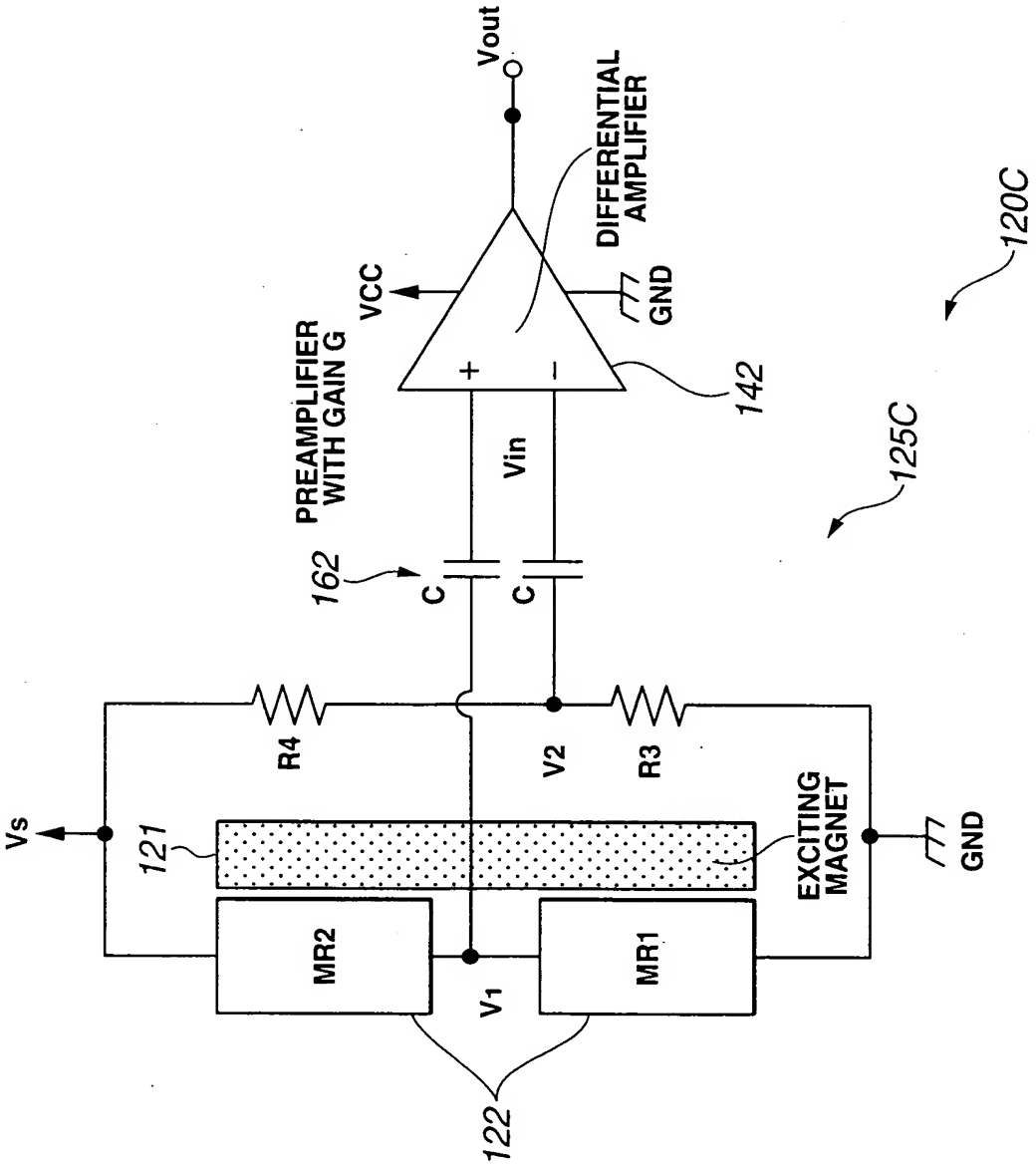

Vout
DIFFERENTIAL AMPLIFIER
VCC
GND
PREAMPLIFIER WITH GAIN G
142
120C
125C
Vin
162
C
C
R4
R3
V2
Vs
121
MR2
MR1
V1
EXCITING MAGNET
GND
122

FIG.35

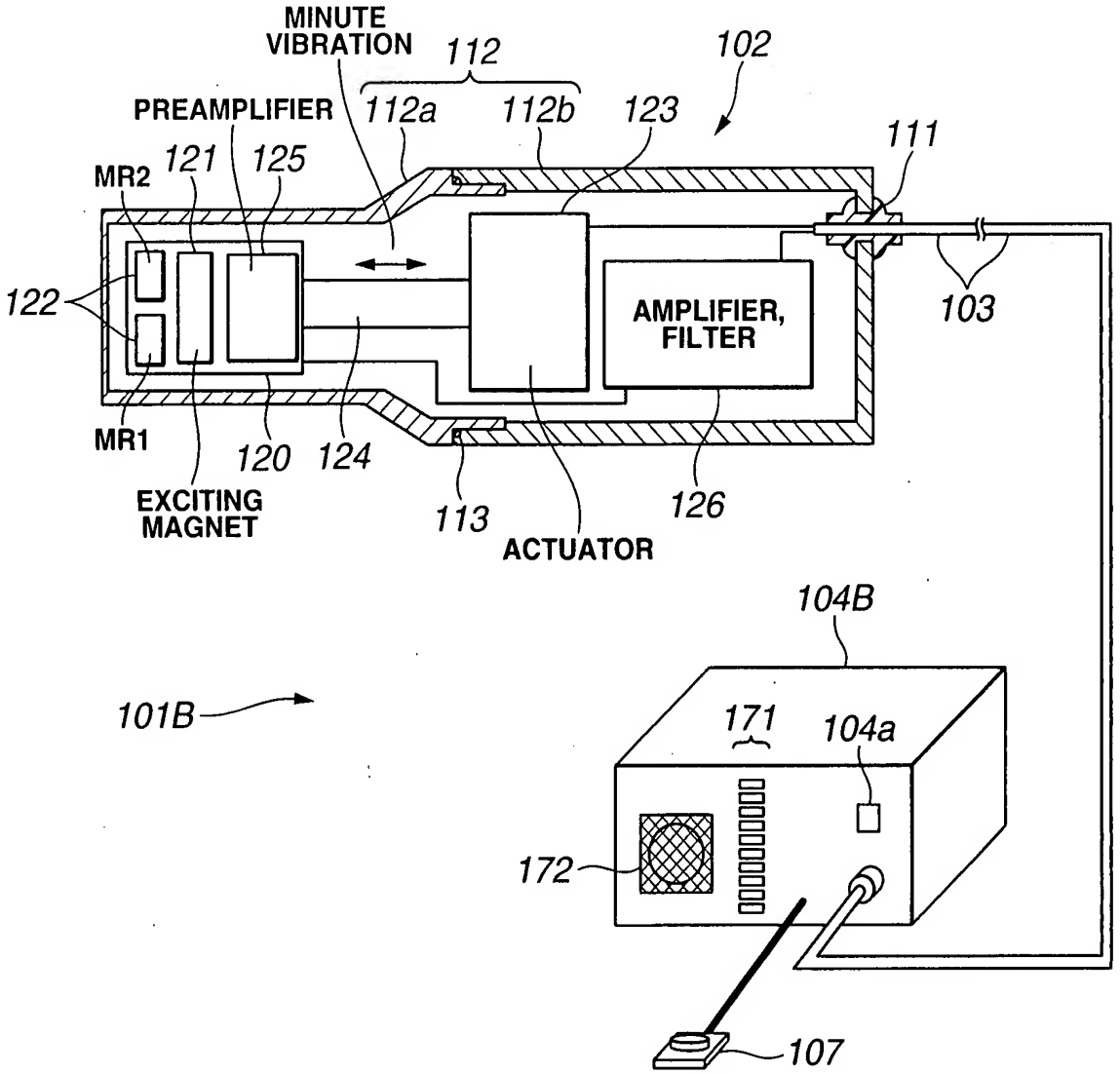

MINUTE VIBRATION
112
102
PREAMPLIFIER
112a
112b
123
111
MR2
121
125
122
AMPLIFIER, FILTER
103
MR1
120
124
EXCITING MAGNET
113
ACTUATOR
126
104B
101B
171
104a
172
107

FIG.36

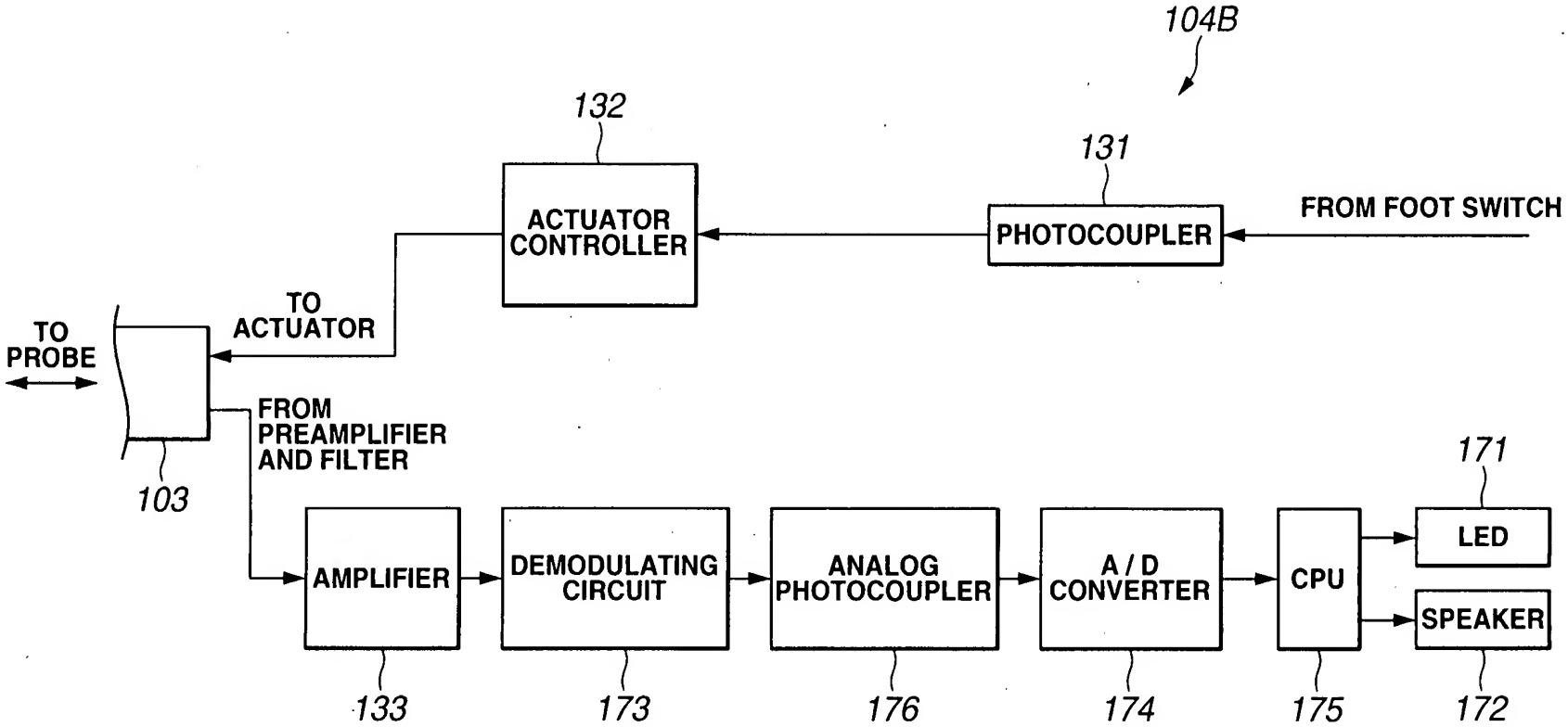

104B
132
131
ACTUATOR CONTROLLER
PHOTOCOUPLER
FROM FOOT SWITCH
TO ACTUATOR
TO PROBE
FROM PREAMPLIFIER AND FILTER
103
171
AMPLIFIER
DEMODULATING CIRCUIT
ANALOG PHOTOCOUPLER
A / D CONVERTER
CPU
LED
SPEAKER
133
173
176
174
175
172

FIG.37

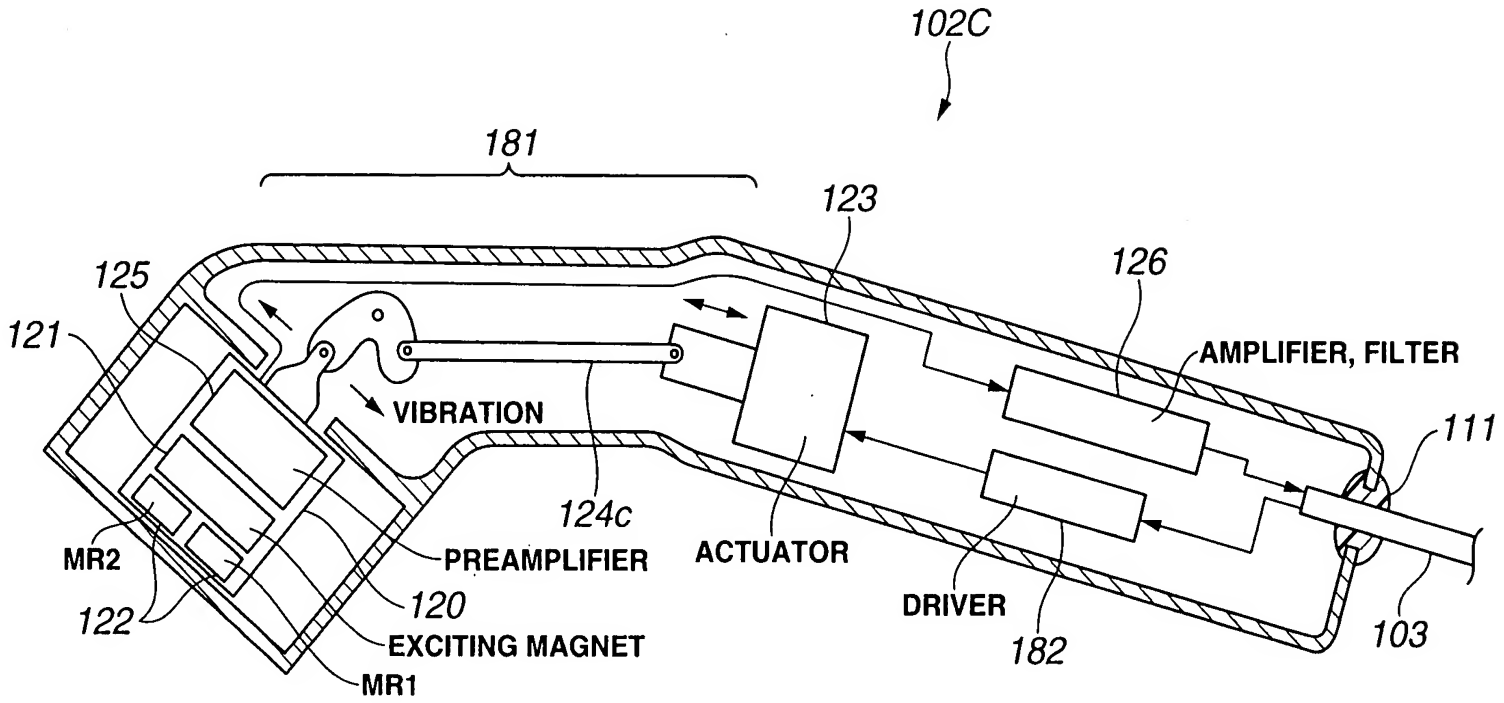

102C
181
123
125
126
121
AMPLIFIER, FILTER
VIBRATION
111
124c
MR2
PREAMPLIFIER
ACTUATOR
120
DRIVER
122
EXCITING MAGNET
182
103
MR1

FIG.38A

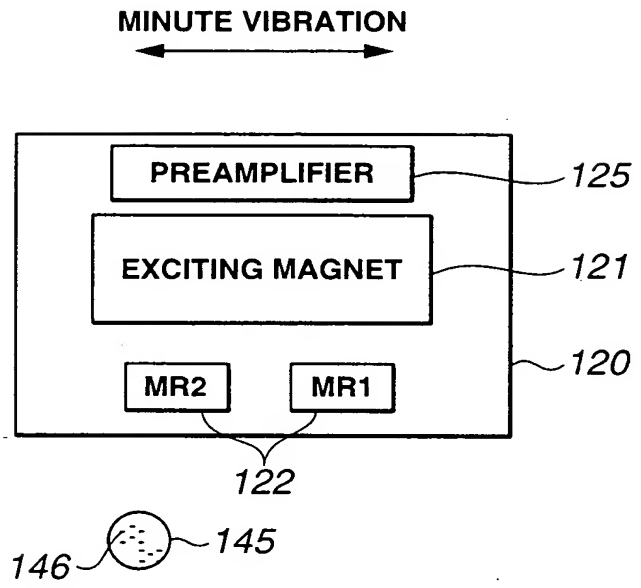


FIG.38B

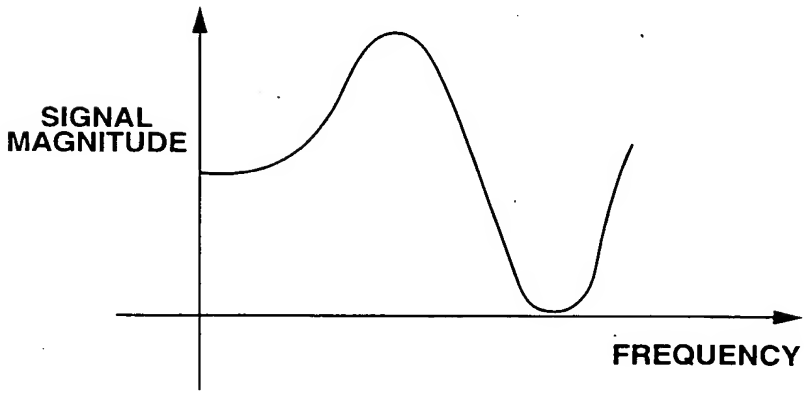


FIG.39

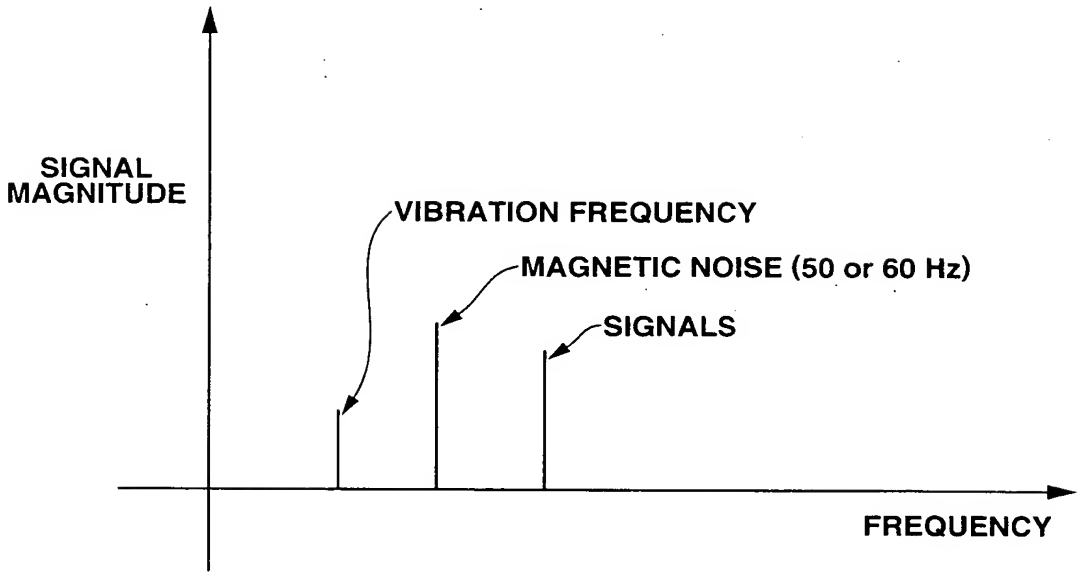

SIGNAL MAGNITUDE
VIBRATION FREQUENCY
MAGNETIC NOISE (50 or 60 Hz)
SIGNALS
FREQUENCY

FIG.40B

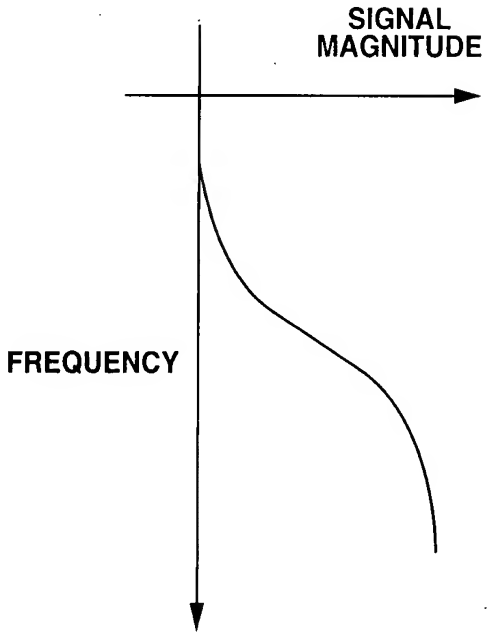


FIG.40A